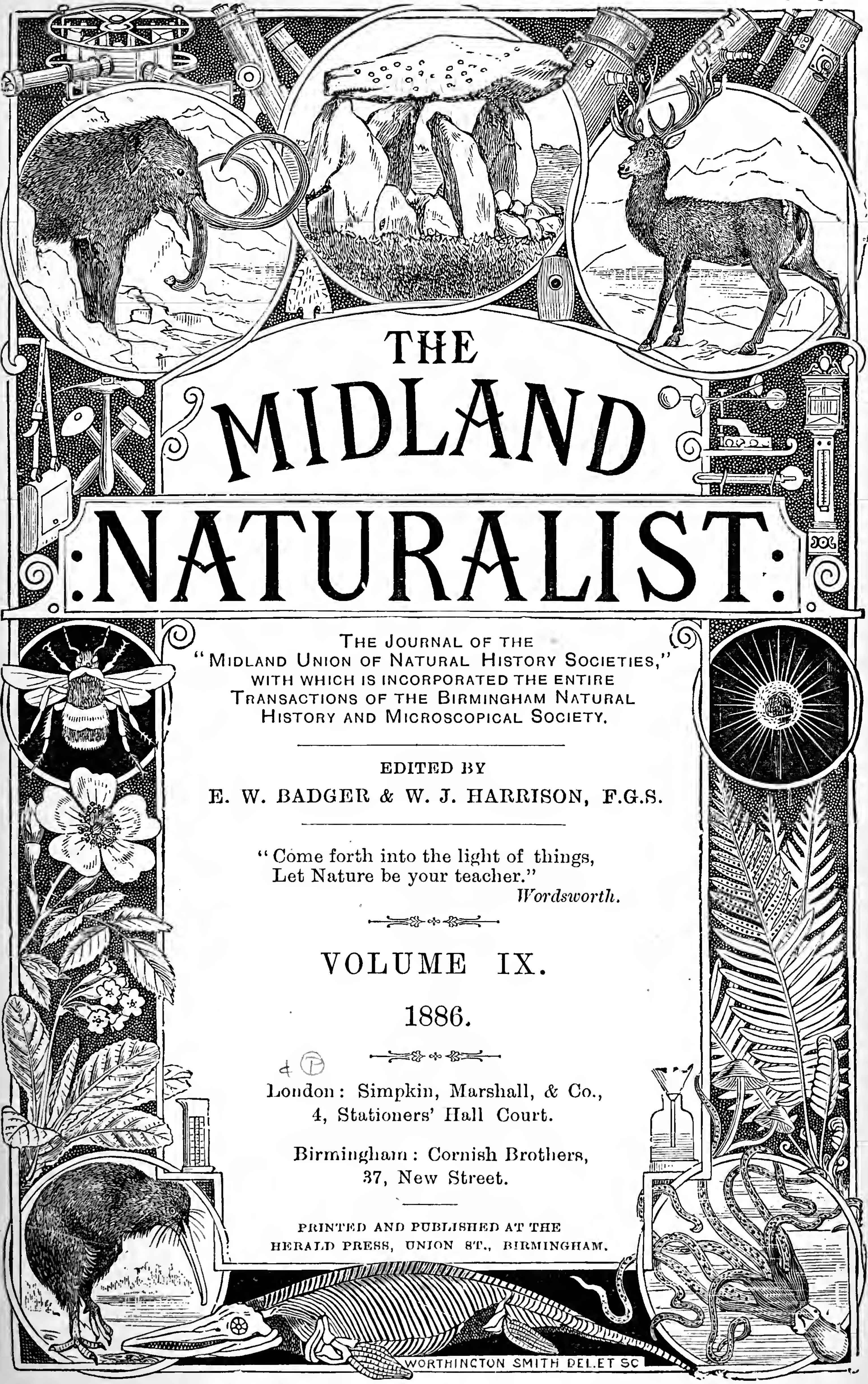

THE MIDLAND NATURALIST

THE JOURNAL OF THE
"MIDLAND UNION OF NATURAL HISTORY SOCIETIES,"
WITH WHICH IS INCORPORATED THE ENTIRE
TRANSACTIONS OF THE BIRMINGHAM NATURAL
HISTORY AND MICROSCOPICAL SOCIETY.

EDITED BY
E. W. BADGER & W. J. HARRISON, F.G.S.

"Come forth into the light of things,
Let Nature be your teacher."
Wordsworth.

VOLUME IX.

1886.

London: Simpkin, Marshall, & Co.,
4, Stationers' Hall Court.

Birmingham: Cornish Brothers,
37, New Street.

PRINTED AND PUBLISHED AT THE
HERALD PRESS, UNION ST., BIRMINGHAM.

PRINTED BY WRIGHT, DAIN, PEYTON, AND CO.,

AT THE HERALD PRESS, UNION STREET, BIRMINGHAM.

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PLATE I.

FOSSILIFEROUS HEMATITE NODULES.

THE MIDLAND NATURALIST.

" Come forth into the light of things,
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ON THE OCCURRENCE OF FOSSILIFEROUS HÆMATITE NODULES IN THE PERMIAN BRECCIAS IN LEICESTERSHIRE,

TOGETHER WITH SOME ACCOUNT OF THEIR ECONOMIC VALUE, &c.

BY W. S. GRESLEY, F.G.S.

The following observations have been written with a twofold view: to make known certain features possessed by some red hæmatite* nodules occurring in the neighbourhood of Ashby-de-la-Zouch, in Leicestershire; and to interest others who have a geological turn of mind, in possibly taking up the questions herein noticed in a more scientific and searching manner than has been possible to the author.

I propose to divide the paper into the following heads :—

Description of Plate I.

No. 1.—Fragment of a nodule of red hæmatite showing a peculiar mammillated or "eyed" agate-like structure. Natural size.
No. 2.—A nodule or "pebble" of very hard and compact red hæmatite. Natural size.
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* Often magnetite, and occasionally compact limonite.

1.—The manner in which, and the localities where the nodules occur.
2.—A more detailed description of the stones.
3.—Remarks upon certain individual specimens.
4.—Origin of the hæmatite.
5.—Uses in the arts and manufactures. Value, &c. Mining notices.
6.—Concluding observations.

1.—It is in studying the superficial geology (the recent or drift deposits) of the district that these hæmatites are brought more especially into notice.

They occur in the shape of nodular lumps and angular or broken fragments from the size of one's fist to mere specks or the smallest of pebbles. They appear to be distributed rather indiscriminately over a considerably large tract of country in certain districts around the town of Ashby-de-la-Zouch, especially on the south, south-west, and west sides, from one to five or six miles distant. They are met with immediately beneath, as well as mixed up with, the surface soil, and here and there have been turned up in considerable numbers at various depths in making excavations of different kinds; the beds of streams also have yielded quantities of them. They are reported to have been picked up at some distance from the Ashby-de-la-Zouch area, namely:—In Nottinghamshire; at Newton Solney, near Burton-on-Trent; Spondon, near Derby; at Ashbourne, Over Haddon, Sandiacre; at Hugglescote, near Coalville, where they occur in a deposit of consolidated calcareous breccia, which was noticed in this Magazine (see Vol. VIII., 1885, p. 237), &c. Thus they contribute to form the alluvium or most recent period of the physical geology of the district. Secondly, they occur in precisely similar forms and sizes in the Permian series of the same neighbourhood, in a breccia.* In these Permian strata,—called by Prof. Hull "meagre traces," —I suppose because they are only a few yards in thickness,† the hæmatite pebbles and fragments are mixed up promiscuously with a variety of other rock-fragments, sub-angular boulders, &c., amongst which are sandstones, in colour, white, yellow, brown, red, purple, &c., often micaceous; quartz (vein-quartz), enclosing patches of greenish slate; quartzite boulders and pebbles; puddingstone, granitic rocks; clay slate of red and of green tints, fragments of igneous rocks, coarse jasper, hornstone, chert, lumps of silicious and of red

* See "Memoir of the Geological Survey of Great Britain—Leicestershire Coal Field," by E. Hull; p. 57, *et seq.*

† Thirteen yards thick at Measham, Derbyshire.

earthy cone-in-cone formation; pebbles of indurated clay and slaty rocks (sometimes much weathered), sand, clay (in lumps), &c. The mass is usually loose, but at one or two places is consolidated, and is locally termed "small pox gravel," "poxen rock," and "grouse." This condition prevails at Measham, Oakthorpe, and Wooden Box. Again, it is commonly found to contain a large proportion of clay or mud, sometimes of an orange colour, but more usually red or variegated. At the Coton Park and Linton Colliery a few years since a drift was made to win the main coal of Moira, and in driving it, at a depth of about 155 yards from surface, the Permian breccia was passed through. It contained blocks of rock as much as half a ton in weight, and I obtained one round nodule of hard hæmatite from it. The localities that have hitherto furnished the largest number of specimens most rich in iron, and the hardest, are Measham, Packington, Overseal, Willesley, and Blackfordby. At Measham the stones (hæmatite) seem to occur in the breccia in patches or clusters rather than to be regularly distributed in the mass. As I have not met with hæmatite, of the peculiar mineralogical characters represented in these stones, in any other beds besides the Permian breccias, I conclude that the whole of this gravel-ore has been derived from these deposits of the district, and that those that occur in the alluvial accumulations have been washed from the outcrops of the so-called Permian series and carried or rolled far and wide by water, possibly assisted by ice. And now we will proceed to

2.—A more detailed description of the stones.*

(*a*) Shapes and sizes.

(*b*) Structure, colour, hardness, fracture, magnetism, organic contents, &c.

(*a*) These pieces of ore occur in a great variety of outward forms, the most common being those having a rounded or water-worn aspect. They are occasionally nearly spherical, finger-shaped, egg-shaped, more or less flat or disc-shaped, potato-shaped, angular, subangular, variously chip or splinter shaped, having usually at least one side more or less rounded and smooth. Their surfaces are often very smooth and even greasy-looking, and bright; but, as a rule, rough and uneven, also pitted, wrinkled, grooved, chipped, dimpled, scratched and bruised, and occasionally are completely perforated. Wart-like excrescences, weather-crusted (showing concentric zones of oxidation), cracks or flaws, cavities, &c., are not

* By "stones" in this article is meant a vast variety of fragments, &c., of rock partaking or composed more or less of the mineral *hæmatite* which I consider has had a common origin.

common, though now and then a nodule consists merely of a thin shell or crust of hæmatite. For a typical set of these stones see Plate I., Figs. 1, 2, 3, 4, 5, 6, 7, 8, 12, and 13. In size they vary, as already stated, from mere grains or minute bright shot-like morsels of about $\frac{1}{20}$ of an inch in diameter to masses weighing some two to three pounds (the weight of the largest I have yet discovered or heard of). I possess the greater part of a nodule which when whole probably weighed about 56oz. The average of all specimens would probably be from 1in. to $1\frac{1}{4}$in. across, or, in weight, about $2\frac{1}{2}$oz. The prevailing colour of the weathered fragments is a reddish brown; iron black and grey are not common, but various tints of red, chocolate, purple, yellow, &c., are frequently noticed. Occasionally they possess a very bright red coating. A few are variegated. Very rarely they seem to be composed entirely of yellow ochre (pure limonite). Those occurring *in situ* in the breccia are mostly either of a red, or yellow and red, and have a metallic or steel grey appearance. Freshly fractured samples exhibit various reds, purples, browns, blue-blacks, and greys. Sometimes a white softish substance is found in them occupying hollows and cracks, which I conclude to be either sulphate of baryta or hydrous silicate of alumina. In the limonite (or göthite) nodules, streaks or veins of manganite sometimes are present.

(*b*) *Structure.*—Some seem to exhibit no structure—to occur massive. We have bedded, granular, concretionary, cellular, mammillated, stalactitic, geodic, columnar, cone-in-cone, banded, porphyritic, scoriaceous (?), compact, coarse-grained, fine-grained, brecciated, &c., specimens. In some samples we find two or three of these forms in a greater or less degree united. The botryoidal or mammillated forms occur in specimens of ore usually resembling vein iron-ore. Micaceous samples are usually earthy, and are often used as "raddle" or "red-rud" in the district. The sp. gr. of the most compact ore, *i.e.*, the steel grey variety, = 4·62.

Hardness.—Say $6\frac{1}{2}$ to 7 for the most compact variety. This characteristic is perhaps the chief point or peculiarity possessed by the nodules, and it is this that qualifies them for employment as "burnishers." When thus used, excessive hardness must be accompanied by absence of cracks or flaws of any kind. It is, however, only a small proportion of the pebbles or fragments of ore that are found to be commercially valuable.

Fracture and Lustre.— Beautifully perfect conchoidal fracture in the hardest and faultless specimens, to irregular, flinty, dull and earthy. The lustre is metallic adamantine (rarely), more often greasy, dull and earthy.

Streak.—The usual *streak* is red. The brown hæmatite or limonite nodules, &c., of course, give a brown streak,* but we do not find the proportion of stones having a decidedly brown streak at all numerous. There is, nevertheless, a considerable percentage of nodules which give streaks varying between red and brown, or rather between yellow ochre and blood red, passing through various shades of brown. In two specimens only have I detected a black streak ; one of them, in appearance, is singularly like some of the celebrated magnetic black oxide of iron so largely wrought in Sweden. It bears an impression of the fossil *Calamites.* The other is a small nodule of magnetite, with a shiny black anthracite coke-like fracture, and of low sp. gr.

Magnetism.—Probably about two per cent. of the lumps may be classed as magnetite, *i.e.*, they possess polarity. Where this property is displayed the specimens almost invariably have their poles residing, not at opposite ends, corners, or sides (or diametrically opposite), but apparently in points having no particular relation to one another; they are often on the same edge, or side, or end of a stone. It is not only in the hardest or brightest nodules, &c., that polarity exists, but it is equally strongly present in specimens the most worthless or earthy. In fact, this property seems to be present only in those specimens that have been exposed to the action of air, rain, &c. I have tested many hundreds of pieces, and have found only one which is simply magnetic or non-polaric; whereas all others that will at all affect the needle display polarity. I am puzzled to account for this fact, and I may also add that this singular individual (a remarkable stone in other respects) possesses its magnetic iron concentrated all in one particular spot—a projecting point on its surface about the size of a pea—the nodule itself measuring about two inches long.

Fossils.—Careful and diligent search has revealed the presence of a goodly number of organic remains belonging to both the animal and vegetable kingdoms in these hæmatites. They are unquestionably of coal-measure age, and, as Permian fossils, are of course only *derivative;* no true forms of that series have, I believe, yet been discovered in this district. The plant-remains—of which a list is appended—occur both upon the outside as well as enclosed in the stones. This is of course natural, as the majority of the specimens are *fragmentary*, and *whole nodules* are not common. Now and

* All limonites, however, do not give the brown streak, *e.g.*, the iron ore of Bilbao, in Spain, so largely employed by our steel and iron manufacturers, gives a *red streak.*

then fossils may be met with showing beautifully delicate structure or nervation of the leaves, scales, &c., of ferns, trees, and allied plants. A reference to Plate I., Figs. 10, 14, and 15, will probably render unnecessary any further description of these organisms. Fig. 11 shows a shell.

Striæ.—Certain parts of the surfaces of some of the stones in question are marked by polishing, by scratches, dimplings, and by deep grooves or worn-away depressions running across or partly round the nodule. The plough and harrow have in many instances produced certain of these, but that ice has been instrumental in forming the greater number of them is, by some geologists, thought to be probable. Sir A. C. Ramsay, some thirty years since, first attributed the striæ observed on rock fragments in the Permian breccias to ice action. Fig. 5 shows a striated pebble. Many specimens exhibit abrading, rubbing, and grinding actions, their rounded edges being worn flat as if by a rasp. It is probably to the work of ice that the angular or chip-like fragments owe their shape, pressure or frost having broken up larger masses. Certain fragments of the ore bearing striations have been examined by Prof. T. G. Bonney and Prof. J. W. Judd, who both agree in considering that these particular markings are not due to ice action. Quite recently I have discovered rock fragments associated with the iron ore nodules in the breccia, the striæ on whose surfaces cannot possibly, to my mind, have been produced by movements of the rocks *en masse*. One or two nodules exhibit *faulting*. The stones themselves are fractured, but have been re-cemented. To great squeezing of the stones one amongst another, when in the breccia, I consider this fracturing to be due. Again great pressure must have produced a singular comparatively large and deep depression or smooth hollow upon the exterior of one of these fragments. Now, this cup-shaped hole has probably been made by another and harder pebble lying in contact with it in the original deposit, which has gradually forced, or as it were, screwed or rubbed itself into its neighbour's side. This depression, which fits the finger end, has been formed since the stone was originally broken up and came to rest in the breccia, because folded or turned back over the fractured side of the fragment is part of a kind of lip or thin edge standing out beyond the general surface of the mass in an irregular ridge or wall of hard hæmatite, which forms the rim of the said dimple. It seems to me that this peculiar feature has been brought about by the more or less continual action of great dynamical pressure—in other words, pressure resulting from

the oscillations or earth-movements possibly continued through long periods of geological time, which the position of the Permian series proves to have taken place. But we must pass on and next notice some

Agates.—Under division 2 (*b*) *Concretionary structure* was noticed. This is very common. Certain very hard and flawless specimens of the ore are, by people in the district who trade in them as *burnishers*, termed "agates," although they may display no visible concretionary markings such as agates proper possess. The term, I fancy, has been applied to signify *excessive hardness*, and adaptability to uses in burnishing, to which the ordinary Scottish, German, and other agates are often put. My reason for calling certain of my specimens "agates" is this. Their *structure*, I maintain, in a great measure resembles that of the true agate. It is true we do not in these hæmatitic forms meet with any transparent or semi-pellucid and variegated kinds, but generally speaking with only two shades of the same colour, and with alternating bands or zones of different density of two kinds; in other words, I have only noticed the parallel or concentric layers to be composed of two shades of red, purple, or blue, as the case may be, however many times repeated. Figs. 1, 3, and 4 illustrate forms possessing agate-like structure. It often happens that good agate-like markings or layers occur in some of the most brittle and worthless specimens. These concretionary markings are occasionally very beautifully and minutely developed; the forms known as "fortification," "eyed," "folded," and "banded," being present. Some of these forms probably owe their origin to minute cracks in the stone which have in some way regulated the development of the peculiar structure seen. Again, we occasionally find specimens (weathered stones) which at first sight look like the remains of nodules, but as a large portion of each of them is composed of a mass of quartz grains cemented together (with red hæmatite inside and brown hæmatite outside the nodule) I am inclined to look upon them as having once been fragments of grit or of quartz rock. The most peculiar feature about them, however, seems to me that the parallel or concentric zones of oxidation not only run through the ore devoid of visible quartz grains, but through the gritty part of the stone as well. The pittings, cup-shaped or conical hollows with "pin-holes" in the bottoms of them, the wart-like and eyed excrescences, and other surface markings on the stones are generally traceable to this kind of con-

cretionary structure in a greater or less degree of perfection of development on some part of the specimen. A few specimens of the brown hæmatite of cone-in-cone structure seem to be closely allied to a concretionary formation.

(To be continued.)

THE MONUMENTAL BRASSES OF WARWICKSHIRE.

BY E. W. BADGER, M.A.

At first, perhaps, an apology seems needed for the appearance of a paper on this subject in the "Midland Naturalist," but a moment's thought will remind our readers, first, that this publication is the organ of the Midland Union, which includes several Archæological Societies, and next, that Archæological notes have already from time to time appeared in these pages.

Only a few short prefatory notes on Monumental Brasses in general will be given here; those who wish complete information on this subject are advised to consult the Rev. H. Haines' "Manual of Monumental Brasses," the Rev. C. Boutell's "Monumental Brasses and Slabs of the Middle Ages," and Messrs. Waller's "Series of Monumental Brasses."

A monumental brass may be described as a plate of brass with an effigy or inscription or both engraved upon it, inlaid in a stone slab, and firmly fixed there by being imbedded in pitch and rivetted. The earlier specimens usually take the form of effigies; later brasses are generally quadrangular. At the head of the figure a canopy is sometimes placed; and armorial bearings, evangelistic symbols, and other ornaments are not uncommon additions. The accompanying inscriptions are found on scrolls, on strips of metal placed round the edges of the slab, but most often on plates at the feet of the effigies. The engraved plates were sometimes gilt, but generally burnished, and the incised parts were filled up with a black or coloured resinous substance.

The plate of which brasses are made, and the art of engraving them, was probably brought from Flanders or France; indeed, some of the early brasses in England, on comparison with existing Continental examples, betray unmistakable marks of foreign production. Foreign brasses consist of large quadrangular plates, engraved with elaborate back-grounds and certain conventional ornaments; English brasses represent effigies without backgrounds. With

the few exceptions suggested, however, the brasses extant in England are the work of English artists; and the metal itself was made in England at least as early as 1565, when Queen Elizabeth granted a patent for its manufacture. It is much to be regretted that, while we may feel confident that certain groups of brasses are the work of the same artists, we are unable to discover who the artists were.

The origin of the use of brasses may perhaps be accounted for in the following way. Marble monuments, with their carved canopies and life-size effigies, however majestic, took up a great space. Effigies in low relief, placed on the floors of churches, were in the way, and, like incised slabs, liable to wear; Limoges enamels were still less suitable for use in a similar position. Hence, about the thirteenth century, monumental brasses came into use, following the incised slab in treatment, and the Limoges enamel, to a certain extent, both in treatment and material, and were at once cheap, convenient, and durable.

To the archæologist the use of the study of brasses is manifold. They accurately represent the vesture of the ecclesiastic, the armour of the knight, and the less extravagant fashions of civil costume. They supply the herald with armorial bearings; and in the mouldings and tracery of their canopies afford valuable data for the history of Architecture. The inscriptions acquaint the genealogist with facts of family history, and the palæographer with the forms of letters in use at different periods; while all may learn from them something of the thoughts and aspirations that have swayed the generations of the past.

Fac-similes of Monumental Brasses may easily be obtained by laying paper (paper-hangers' lining paper is most convenient) upon the brass, and rubbing the paper with shoemakers' heel-ball. Care should be taken to first brush out all dust from the incisions in the brass, and to fix the paper securely by weights or wafers. Rub hard so as to produce a good black impression; a result which will be further facilitated by carrying the heel-ball in the trousers' pocket previous to use, by which method the heel-ball is slightly warm.

Many pleasant holidays may be spent in collecting rubbings of these interesting memorials. This pursuit invigorates the body, quickens the imagination, and links one more closely with the bygone. There is the refreshing walk through country lanes far from smoke and noise, and then in some remote church, whose windows have let in the light of centuries, one stoops down in the quiet aisle and

with rustling of paper and rattle of heel-ball takes a rubbing of the effigy of some warrior who haply fought at Creçy or of a courtier who once kneeled to hand the signet-ring to a Tudor.

In succeeding papers will appear a list of places in Warwickshire where brasses are to be found. The notice in Haines' "Manual of Monumental Brasses" will in each case be quoted, and a minute description of extant brasses derived from rubbings made by the writer will be given, together with any interesting details concerning the person commemorated which can be obtained.

ASTLEY. I.—*A lady of the Astley family (?), circa* **1400,** *in mantle, lower half of effigy and inscription lost. Haines.* —This brass is lying loose on a tomb near the west door. Its length is 2ft. 6in. by 13in. The head, lower part of the effigy, inscription, and canopy, if it had one, are all lost. The lady wore upon her head a veil or kerchief, the ends of which fall upon the shoulders. Her outer garment is a mantle reaching to the feet and drawn together across the chest by a tasselled cord passing through two metal loops *(fermailes)*, one fastened in front of each shoulder by a jewelled metal stud. Beneath the mantle is seen the kirtle, a long close-fitting dress with sleeves reaching to the knuckles. Over the kirtle is a dress with the sides cut away from the shoulders to the waist, leaving large openings through which the arms pass. The edges of these openings were generally trimmed with fur. In the present example this border was represented by enamel, which has all disappeared. The front of this garment is ornamented or fastened with metal clasps. The hands of the effigy are in the attitude of prayer. A similar brass is figured in "Haines' Manual," p. 169.

In "Dugdale's Warwickshire," p. 118 (edit. 1730), is figured a lady under a canopy, with the following imperfect inscription: " . . . morust le primer jour d'aprill l'an de grace mill: cccc et . . . del alme de quele dieu eit mercy: Amen." This may be translated: " . . . died the first day of April in the year of grace one thousand four hundred and . . . on whose soul God have mercy: Amen." Possibly this inscription belongs to our brass, though this is mere conjecture.

The other brasses in the church which are figured in "Dugdale," *l.c.*, are gone; their matrices are, however, visible.

II.—At the west end of the nave, over a pew, is a mutilated plate with an inscription in black-letter or Gothic characters, which reads as follows:—

............charite pray for ye sowlle of John Crugge som........ | ...... Exest' gentilmā & Barbara his wif whiche John Crug.... | ....n ye Countie of Midd ye xviii day of december Ano dni Mo vcxxxiv | ..f ye reign of Kyng Henry ye Eight xxvth & ye said Barbara died | ....ay of Ano dni Mo Vc ō whose sowlle Jhū have m......

It is evident that the husband died first, and that the blank spaces were left in order that the date of the wife's death might be filled in when it occurred. Many similar instances will be found.

III.—Near the last inscription is a small quadrangular plate, 12in. by 8in., bearing the following inscription in Roman letters:—

I AM SURE THAT MY REDEEMER
LIVETH AND THOUGH WORMES
DESTROY THIS BODYE YET I
SHALL SEE GOD IN MY FLESH.

Here lyeth the body of William Beck
of Aftley whoe departed this life
March 21 Ano Domini 1623
and hath giuen yerely vi^{s} viii^{d}
to the saide parish of
Astley for euer.

(To be continued.)

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.

PRESIDENT'S ADDRESS.*

BY T. A. WALLER, B.A., B.SC.

When, twelve months ago, you did me the honour of electing me to a second term of the presidency of this society, the great kindness which I had already received in the discharge of the duties of the office left only one aspect of the situation which appeared at all formidable, which was that when the year had expired I should have to deliver a second "retiring address," and, my choice of subjects

*Transactions of the Birmingham Natural History and Microscopical Society. Read April 28th, 1885.

being very limited, I was afraid that I might fail to find anything which would interest you among the Geological problems of the year.

The kind and hearty co-operation and assistance which have been afforded me since then have made all the functions of the office not only easy of fulfilment, but pleasant in the performance, and I can only tender to all those with whom I had the good fortune to be associated, the expression of my heartfelt thanks for the unfailing courtesy with which they have supplemented my many deficiencies. The work of a society such as this can only be satisfactorily carried on by those who have help to give extending it to all those who wish it; such, I take it, is the object of our association, and I believe it is to a very considerable extent fulfilled. It seems, however, worthy of consideration whether we might not, by a little more thought for the requirements of our younger members, make our meetings still more generally useful. The papers which are read frequently appear to mark the furthest point of knowledge on the subject treated of, and although this is, of course, a most important part of our work, and one which can by no means be lost sight of, there are many evenings which might suitably be filled up either with quite elementary papers on Natural History subjects, or with some rather more systematic "exhibition of specimens" than is usually provided for us. After all, the meetings depend entirely on those who attend them, and the remedy for a deficiency which any member feels is, to a great extent, in his, or her, own hand. The Committee is always most anxious for the maintenance of the interest of the meetings, and would, I am sure, welcome any promises of papers or specimens from others than the comparatively few members who at present furnish most of them.

As to Geological subjects, to which I may make reference, I am again fortunate, for although there have been no great volcanic eruptions such as that which made the year 1883 memorable, we have had reminders even in our own quiet island that our quiescence is only relative and temporary. During the year two of the most severe shocks of earthquake which have happened in these islands for probably a century or two have affected the east and north-west of England respectively. The latter seems to have attracted comparatively little notice; the former caused an excitement all through the country which some persons who saw the effects thought to be rather disproportionate to them, but which was an undoubted boon to the many poor people whose property had suffered. At any rate, more damage was done than has been caused by

any earthquake in England within living memory, so that perhaps we are justified in making much of it. We have had the pleasure of seeing photographs of some of the effects of the earthquake, taken within a day or two of its occurrence, which clearly showed the direction of the wave which passed through the ground. I have only seen the record of one observation which gave any idea of the amount of vertical displacement. This was, that a man was enabled at the moment of the shock to see through opposite windows in his workshop from the ground outside, and measurements showed that he must have been lifted at least 2ft. 9in. Another man describes the appearance of the movement over the level salt marshes as like the wind passing over a field of corn, only quicker. A curious effect of the movement of the strata was the increase in the town water supply of Colchester. For some time previous the supply had been diminishing, so that the suction pipe, which had been already somewhat lengthened, was about to receive another addition, but immediately after the shock the water had risen seven feet in the wells, enabling about two hours more supply daily to be given, at the same cost of pumping. Whether this increased supply has continued to the present time I have not heard, but all the wells in the district seem to have been similarly affected. If the failing of the supply was produced by the opening by subterranean movements of cracks which tended to drain the wells, the closing of these cracks by the settling down which produced the earth wave would very likely permanently increase the available supply. If, on the other hand, the earthquake opened cracks in the chalk so that the water flowed down more freely, as is suggested by Mr. de Rance, the increased flow would probably be only temporary.

As to the limits over which the shock was felt, it is recorded from South Yorkshire, Boulogne, and Street, in Somersetshire. A rather curious suggestion has been made as to the relation of this shock to the floor of Palæozoic rocks which is known to underlie not only the Midland district but the Thames valley and the Eastern Counties; deep borings having reached them in Harwich, near the centre of the disturbance, London, and at various points about due North and on to Northampton, while they come to the surface in the Mendip Hills south of Bristol, and in patches across the Midland and North Midland counties. Now it is almost certain that the shock originated far below the upper surface of these hard and compact rocks, and shocks of any kind are naturally much more readily propagated in such rocks than in the looser and softer strata of

chalk, sands, clays, &c., which overlie them. It is known that the superincumbent rocks are much thicker in the south-east of England, in the district of the Weald of Kent, and it is possibly owing to this circumstance that only very few records of observations of the shock from that district are forthcoming. From this cause, too, may arise the double shock noticed in many places; the first being due to the more rapidly transmitted wave in the harder, the second to the slower one in the softer rocks.

It was noticed that the cracks in the walls of buildings were at an angle of about 30°, while in the chimneys this was increased to 40° or 45°. In one of the churches two cracks, at angles of 32° in opposite directions, met over the door. One house was rent spirally, and the observation of chimneys having been twisted was made in several instances; in one case the side that had been to the south was facing almost south-east. Whether this twist is due to an actually changing direction of the shock or to the centre of gravity of the building not coinciding with the centre of figure is still undecided; the more general opinion being the former, while Mr. Mallet holds the latter. That there was more than one shock is made probable by the fact that one man described the movement which he felt as being like "three seas." There is also a good deal of evidence of varying direction in places quite near each other; but this may very probably be due to the damage having been done in the one case by the direct throw and in the other by the backward movement. Altogether it seems probable that the shock originated a short distance to the south-east of the village of West Mersea, where, emerging nearly vertically, it did but little damage, and travelled outwards from that centre with a velocity and a violence dependent upon the nature of the material through which it was propagated. At Kew, the magnetographs recorded the shock, and from the fact that the magnets which showed the greatest disturbance were those which lie east and west, it was inferred that the shock was more nearly north and south than at right angles to this.

The interest awakened by this occurrence in earthquake measuring in general produced a series of papers in "Nature," Vol. XXX., on the subject, to which I may refer any who would like further information. Our own little tremors seem, however, scarcely worth mentioning by the side of the terrible disturbance in the south of Spain, where so many lives have been lost—as many, perhaps, by privation and exposure to most unusually inclement weather as by the actual fall of the buildings in the towns and villages destroyed by the earth movements.

In this case the phenomena appear to have been definitely related to the line of the mountain chain, so that we are probably justified in assuming that they are the concomitants of the great process of mountain making which seems to be constantly going on at one place or another of the earth's surface, in that almost imperceptible way which is so calculated to teach us patience and show us how little we can actually pretend to know of the processes which have gone to fashion the surface of the earth, however much we may feel ourselves justified in deducing them from the present state of things. The geological clock ticks centuries; we hear one; who will hear the next, and how are we to combine the experience of our predecessors with our own to obtain a notion of the course of geologic change?

In my address last year I mentioned the controversy which was then being carried on with so much vigour as to the proper interpretation of the record of the rocks in the north-west of Scotland. At that time the question seemed likely to furnish matter for discussion for a long time to come. In the issue of "Nature" for 13th November last, however, there appeared a communication from Dr. A. Geikie, the Director-General of the Survey, accompanying the report of the field observers specially detailed by him for the service of examining the district over again, and, if possible, finally determining the matter. He confesses that their report so much surprised him that it was not until he had himself been over the ground with the observers that he was able to accept their conclusions. As to these conclusions it is sufficient to say that they almost unreservedly, and in many cases verbally, corroborate the views which have been strenuously advocated by what may be called the unofficial geologists of late years. They even go beyond them in some details—for instance, they mention a case in which the thrust of rock has been so enormous just at the fault plane that there is proof of a movement of ten miles along that plane, a patch on the top of a mountain having been originally connected with other masses at that distance from it, although denudation has since then removed the intermediate portions. The "Geological Magazine" for March of this year contains a summing up of the whole affair from the pen of our member, Professor Lapworth, under the title of "The Close of the Highland Controversy." He shows that in almost every individual conclusion to which the officers of the Survey have now found themselves driven, they are but endorsing an opinion of some one or other of the unofficial geologists who have for many past years studied

and described the Highland rocks. It is, therefore, an excellent instance of the power of a name and official position when we find the *Times*, which, of course, we usually look upon as omniscient and infallible, gravely stating, in a summary of the scientific events of the year, that the Geological Survey had at length discovered the true relations of these old rocks.

Perhaps I may, somewhat at the risk of repeating what I said last year, give a general outline of the final results of observation.

The unaltered rocks which occur in north-west Sutherland and Ross are the Torridon sandstone, the quartzite, the fucoid group, and the Durness limestone. This limestone, which contains fossils of species which point to a Lower Silurian age, is the newest sedimentary rock of the district, the so-called upper quartzite and limestone being repetitions of the corresponding beds mentioned above. Over this mass of rocks the eastern metamorphic rocks (the so-called newer gneiss) have been thrust by earth movements which have of course acted since Lower Silurian times, and the schists and gneisses which in Sango Bay, &c., appear to lie upon the limestone have really faulted junctions. These correspond to the similar rocks in the zones of pressure schists in Eriboll, about ten miles to the south-east. Up to this point there is now substantial agreement, but as to the nature of the metamorphism of the eastern series and the original material from which it has been elaborated there is still some difference of opinion. Are we to look upon these rocks merely as a division of the old Archæan gneisses, which, as I stated before, is the opinion of Dr. Callaway, or, with Professor Lapworth, consider them as an intimate and to some extent recrystallised mixture of all the rocks in existence n the region prior to those terrific movements of the earth's crust which have been spoken of above? In this case the planes of schistosity, lamination, and foliation are not planes of bedding, but of shearing and cleaving, along which the rocks have yielded to the lateral pressure. From this it will be evident that in the words of Professor Lapworth "The results already attained in the north-west are merely the preliminary sketches for a great and a most necessary work, namely, the detection of the chief laws of mountain stratigraphy and the discovery of the more important processes of regional metamorphism. It seems to me that these are the conclusions that every one who knows the facts is certain to draw for himself from the startling and sudden collapse of the brave Murchisonian hypothesis in our midst, and that they ought to have the effect of banishing

partizanship and of teaching us scientific toleration and mutual respect. At the present time the several groups of students of these old rocks are all met together upon one and the same elevated platform of a common opinion, having climbed up painfully thereto from many different directions. Continental geologists, British amateurs, and the officers of the Geological Survey are now at one and the same point. They stand together on the shore of a new world of geological discovery, full of the richest promise."

I have ventured to copy these sentences from the paper in the "Geological Magazine" before indicated, because they appear to me to describe this almost unique position in the history of geological inquiry in words so far superior to any at my command that anything which I might have attempted to write could only have seemed like the mutilated echo of them.

(To be continued.)

THE MIDDLE LIAS OF NORTHAMPTONSHIRE.

BY BEEBY THOMPSON, F.G.S., F.C.S.

PART I.

(Continued from page 314.)

The rock-bed has been quarried both right and left of the railway, but I need only refer to one section just south of the line, and about a mile west of Byfield Station, and this only because the transition-bed is fairly well developed there. The following fossils were obtained:—

Ammonites acutus	*Actæonina Ilminsterensis*
,, *Holandrei*	*Cryptænia consobrina*
,, *fonticulus ?*	*Chemnitzia semitecta ?*
,, *spinatus* (small specimen).	,, *foveolata*
Astarte subtetragona	*Trochus sp. ?*
,, *striato-sulcata*	*Rhynchonella tetrahedra*
Plicatula spinosa	*Terebratula, &c.*

North of Byfield there is a small quarry on Blackdown Farm, about half a mile beyond Iron Cross, towards Hellidon. The rock is a ferruginous sandstone about five or six feet in thickness, and about midway in the section is an irregular layer, full of ossicles and broken shells of many kinds; just above this layer is a hard bed containing many specimens of

Waldheimia resupinata. There is no clay capping to the rock here, a fact which might with certainty have been predicted from the deep red colour of the soil around.

A little beyond the last-mentioned quarry, and about a mile and a half from Hellidon, there is another showing about six feet of the rock-bed. It is situated on Stirch Farm, parish of Priors Marston, and we find the Lower Cephalopoda-bed, Fish-bed, Transition-bed and Rock-bed, all very much the same as at Byfield.

A good deal of Marlstone has been quarried around Hellidon, but most of the quarries are now obscured. One, however, has been recently re-opened in a field just south of the village. The Serpentinus-beds are particularly well shown, but the Fish and Insect-beds are represented, if at all, by a thin marly layer containing numerous ammonites, only one inch in thickness, and the Transition-bed seems entirely absent. The Rock-bed is found here in large blocks, very little broken up by fissures, and would probably make a good building stone. *Terebratula punctata*, *Rhynchonella tetrahedra*, and *Pecten liasinus* were fairly abundant.

At Upper Catesby, just opposite the Staverton Road, is an old quarry showing about five feet of Rock-bed, with, at the top, a very fair development of the Transition-bed, some two inches, the latter yielding *Ammonites acutus* and *gastropods*. The soil above contains many pieces of limestone belonging probably to both the Fish-bed and Cephalopoda-bed.

Following the road from Catesby to Badby we came across a small quarry near to Arbury Hill; the section consists of the Rock-bed, capped by fragments of the Transition and Cephalopoda-beds; the fragments of the former are rather hard, and the fossils in consequence fairly well preserved. *Ammonites acutus* is found, and many small *gastropods*; one uncommon form, a *Trochus* approaching *T. mysis* (d'Orb), is found here. The following fossils were obtained from the rock-bed at this place :—

Belemnites
Pecten liasinus
Cardinia concinna (Sow.) or *C. philea* (d'Orb), large specimens
Rhynchonella tetrahedra
Terebratula punctata
Waldheimia resupinata

A little nearer to Badby the rock-bed may again be seen in a small section presenting its ordinary characters, and I mention this in particular because to the east of Badby we meet with a rock which, from its position, would certainly be taken to be the rock-bed, but which I believe is only partly that; it is probably just at the commencement of the extensive

"fault" which runs right to and most likely beyond Northampton, a "fault" which cuts out much of the Middle Lias on one side of the Nen Valley between the points named.

At STAVERTON, situated about a mile north of Catesby, there are several ponds in the village the water of which is thrown out and held up by the clays immediately below the rock-red, the rock-bed itself being seen around them. It is this character of the underlying clays that makes the rock-bed itself such a reliable source of water supply. The "*Margaritatus*" clays and marls seem all of them to be very pervious to water; we have, therefore, in this character of impermeability a rough means of distinguishing the "*Spinatus*" clays from the "*Margaritatus*" ones, although the two are very similar in appearance. Of course these remarks only apply to the district under discussion.

The ponds at Staverton are situated as follows:—First, about a quarter-of-a-mile along the Daventry Road; second, just at the corner of the Daventry Road, and in the village; third and fourth, close to each other on the N. side of Staverton; fifth, about the centre of the village.

Some four miles north-east of Staverton we came across some very fair sections of the "*Spinatus*" *Zone*, near to the village of WELTON. Here an outlier of Middle Lias is met with, in which a small patch of Upper Lias has been preserved by a "fault." About a quarter-of-a-mile from Welton, towards Braunston, near to the junction of two roads, is a small pond, one side of which shows the following section:—

SECTION AT WELTON.

	Feet	In.
1.—Soil and sandy clay, not calcareous	2	0
2.—Irregular rubbly ironstone, somewhat concretionary, containing *Myacites*, *Pleuromya costata* (*rather abundant*), *Protocardium truncatum*, *Aviculæ*, *&c.*	1	3
3.—Sandy and highly micaceous clay, not calcareous, containing *Avicula inæquivalvis*, *Protocardium truncatum*, *Gasteropods* (*Actæonina?*), *Terebratula?*	3	0

This section is situated near to two others, showing only the rock bed, and can be only a little below them; also the lower bed seems to be fairly impervious to water. Hence, I conclude, they belong to the "*Spinatus*" *Zone*, and that they may be "C" of the typical section. None of the fossils found were sufficient to decide the zone to which the section belonged, though I think that one of the fossils I managed to spoil in extracting from the soft matrix was *Terebratula punctata*, and this I have never yet found in the "*Margaritatus*" *Zone* of the district.

Some little distance from the section just described there is a clay pit, where the "*Communis*" *beds* of the Upper Lias are worked for brick-making, and some two hundred yards north of this is a very fair section of the rock-bed.

SECTION AT WELTON STONE PIT.

	Feet	In.
1.—Soil and marly clay, light coloured, containing a few small ammonites	2	6
2.—CEPHALOPODA-BED, sandy, light yellowish colour, containing very many *Ammonites, of the falcifer group*, and also a fair number of *planulate ones. Ammonites acutus? Belemnites* (*many*), *Gasteropods, Astarte, Pentacrinite joints* ...	0	8
3.—ROCK-BED. No very decided break between this and bed above.		

	Feet	In.
Ferruginous sandy bed	0	10
Band almost made up of small pebbles or concretions	0	6
Ferruginous sandy bed, most sandy towards bottom; in places almost made up of shells...	2	6
Total	3	10

Rhynchonella tetrahedra, Terebratula punctata, Ostrea (*large*), *Pecten æquivalvis* (*large*), *Aviculæ, Belemnites* (*large*).

Shows bedding planes well in places; joints numerous, some filled in with lenticular crystals of carbonate of lime.

On the south side of the clay pit another small opening showed a section very similar to the above.

There are also two or three very interesting sections along the L. & N. W. Railway between Long Buckby and Crick Stations, showing that the Middle Lias is well developed there. The first is not far from Watford Village, and is as below.

SECTION AT WATFORD.

Upper Lias.

	Feet	In.
1.—LOWER CEPHALOPODA-BED, a rather sandy limestone, containing many large *Ammonites of the falcifer group*, and numerous *Gasteropods*, including the rather rare *Nerinea liassica*	0	6
2.—SHALE. Very red in lower part. No fossils detected	0	2½

3.—FISH-BED. A semi-nodular limestone, whitish, containing *Euomphalus minutus* and many *Fish fragments, Wood, &c.* 0 3

MIDDLE LIAS.

4.—RED SANDY CLAY, not persistent. One large specimen of *Pleurotomaria araneosa* found, but no other fossils ... ... 0 $2\frac{1}{2}$

5.—TRANSITION-BED and ROCK-BED. A rather soft stone, having the same reddish mottled appearance so characteristic of the rock-bed on the Dorsetshire coast. The upper part is very full of *Gasteropods* and small specimens of *Rhynchonella tetrahedra*, and also contains *Ammonites acutus, Falcifer ammonites, Belemnites, &c.*, and *a large number of small pebbles*, and so is probably the representative of the Transition-bed, although it cannot be separated from the bed below. *Ammonites communis* is met with on the Rock-bed several inches below the surface 0 10

This section is in several respects peculiar. In some places, and within a few feet of that where the above section was taken, we find the Rock-bed, Transition-bed, Fish-bed or Cephalopoda-bed (and perhaps in some cases both), forming only one block of stone, just as the Rock-bed, Pleurotomaria-bed, and Cephalopoda-bed may be found combined in the coast sections west of Bridport. At a depth of about ten inches from the top the Rock-bed becomes suddenly shaly, bluer, and more like clay further down still, and totally unlike the Rock-bed as usually found. In one or two places there seemed to be an indifferent kind of separation between the hard rock and the shale.

I certainly feel doubtful whether this is a part of the Rock-bed; or, indeed, a part of the "*Spinatus*" *Zone.* It only yielded a few aviculæ itself, but just at the junction with the undoubted Rock-bed *Protocardium truncatum* was met with, and this is exceedingly rare in the Rock-bed of the district. The beds above and below those given in the section were too much obscured to admit of easy examination.

A little further along the line towards Rugby, and perhaps less than a mile away, there is a short tunnel through a Middle Lias Hill, and on each side of the tunnel several of the hard beds can be fairly well examined. A section is given below.

Section on the London and North Western Railway, near to Watford Lodge.

	Feet	In.
1.—Soil, &c.	3	0
D.2.—Calcareous and ferruginous sandstone, shaly, and abounding in fossils, though not many can be got out whole—a fair amount of comminuted shell. On east side of tunnel divided about midway by a thin soft shale about 3in. thick. *Ammonites margaritatus (a single poor specimen), Belemnites paxillosus and others, Pleurotomaria heliciformis, Ostrea sportella, Ostrea cymbium var. obliquata, Pecten æquivalvis, Pecten liasinus, Protocardium truncatum, Cardita multicostata, Astarte striato-sulcata, Wood*	2	3
E.3.—Reddish sandy clay, as far as could be made out very much resembling soft beds, at Staverton	13	7
F.4.—Reddish mottled ferruginous limestone, containing argillaceous nodules, shaly in places, and in others very much resembling the bottom bed "L." Very fossiliferous. *Ammonites margaritatus, Belemnites (few), Gasteropods (abundant in places, but mostly casts), Turbo aciculus, Ostrea cymbium var. obliquata (abundant), Ostrea submargaritacea? Pecten liasinus, Plicatula spinosa (abundant), Avicula inæquivalvis, Protocardium truncatum, Cardita multicostata, Cardinia lævis (rather abundant), Astarte striato-sulcata, Pholadomya, Pleuromya costata, Ditrypa circinata*	3	0
G. H. I. 5.—A light brown sandy, micaceous, and ferruginous clay or shale. Not calcareous, very porous, few fossils. This description given from a very slight exposure	19	6
J.6.—Rather soft, shaly, micaceous, and calcareous stone, a little ferruginous, containing *small Gasteropods, Pecten liasinus, Protocardium truncatum, Limea acuticosta (abundant), Circa liasina, Fucoids markings (abundant)*	3	0

The measurements for the beds were made on the incline and an allowance afterwards made for an inclination of 35°.

It will be noticed that I have included in the 19 ft. 6 in. three beds. This plan seems best because it is a great thickness for one bed, and, moreover, the bed H. is so soft in some other places that it could scarcely be expected to form a conspicuous feature in a railway bank. The bed "L" appears to be absent altogether here, for although the section extends down some 35 feet further, measured on the slant, no trace of it is to be found; moreover, on the north side of the line, at a depth of about 4 feet ($7\frac{1}{2}$ feet on the slant) below bed "J," there is a tolerably good spring of water, shown by the line of rushes and the swampy condition of the ground, and this would appear to be the base of the set of beds I am describing as Middle Lias. The spring is well marked in the tunnel itself on the north side, for the brickwork is exceedingly wet to a height of seven or eight feet, and all overgrown with lichen. The pipes let into the side seem quite inadequate to carry off the water; indeed, the water runs out of the tunnel in quite a stream. The south side of the bank and tunnel seem quite dry, no doubt owing to the inclination of the beds, and singularly the spring cannot be detected in either bank on the side of the tunnel nearest Crick Station.

(To be continued.)

Review.

Phillips's Manual of Geology, Vol. II.; Stratigraphical Geology and Palæontology. By R. Etheridge, F.R.S. 8vo., XXII. and 712 pp.; ——— woodcuts, and thirty-six plates. Published by C. Griffin and Co., Exeter Street, Strand; price 34s.

The first volume of this excellent manual (written by Prof. Seeley) we noticed some few months back, and we have now great pleasure in announcing the completion of the work by the pen of Mr. Etheridge.

The frontispiece consists of a coloured geological map of the British Isles, which, though necessarily small, is very clear and distinct. In the preface the author compares the number of British fossils now known—16,000 species, belonging to 3,680 genera—with the list given by Prof. Morris in his "Catalogue of British Fossils," published 1854, and which included 4,000 species, belonging to 1,280 genera. So great an advance clearly demanded an entirely new treatment of the subject, and we are glad to say that the book which lies before us may be taken as entirely Mr. Etheridge's own work; "the plan of Phillips has been adhered to; but of the *text* itself, few pages of the edition of 1855 now remain."

Of all our English writers on geology, Mr. Robert Etheridge was probably the best fitted to undertake the description of the extinct life whose remains are contained within our rocks. For many years palæontologist to the Geological Survey, the labour of cataloguing and describing the fossils collected in every part of England and Wales has given him an extreme familiarity with fossils belonging to

the kingdom and sub-kingdom of Nature. The richness of the knowledge so accumulated was evidenced in the two remarkable addresses given by Mr. Etheridge to the geological world when he was President of the Geological Society; but he was there limited by space, and in the manual he has now written Palæontology finds, almost for the first time, a careful and detailed chronicler.

In the first chapter the author explains the general principles of historical geology, and gives a succinct account of the strata forming the earth's crust, including a very useful and detailed table of the known fossiliferous formations. Commencing, then, with the lowest and oldest rocks—the Pre-Cambrian—all the strata are dealt with in turn up to, and including, the period when man enters on the scene.

The thirty-six plates are beautifully executed on tinted paper, and include the characteristic fossils of each formation. Besides these, there are "one hundred and sixteen tables of organic remains, brought down to 1884, embracing the accumulated wealth of the labours of past and present investigators during the last thirty years. Eleven of these tables contain every known British genus, zoologically or systematically placed, and with the number of species in each, showing their broad distribution through time. The remaining one hundred and five tables are devoted entirely to the analysis, relation, historical value, and distribution of specific life through each group of strata."

These tables will be simply invaluable to the earnest student of palæontology. The whole book stands alone; we have nothing else like it, or equal to it in its own field, in our geological literature.

W. J. H.

METEOROLOGICAL NOTES.—November, 1885.

Barometric pressure underwent some great changes during the month, the range amounting to 1·308 inches. After an unimportant fall, the mercury rose to 30·3 inches, fell rapidly to 29·7 inches, rose again, suddenly, to 30·4 inches, and then fell gradually to 29·1 inches, rising again at the close of the month. Temperature was also variable; the mean was about the average. The diurnal range was as much as 22 degrees; as little as 1 degree. The highest readings were 58·0° at Henley-in-Arden, and 56·0° at Coston Rectory, on the 28th; 57·4° at Loughborough, and 55·7° at Strelley, on the 2nd. In the rays of the sun, also on the 2nd, 92·9° at Loughborough, and 89·5° at Strelley. The lowest readings were 22·0° at Loughborough, on the 17th; 24·5° at Coston Rectory, on the 16th; 25·0° at Henley-in-Arden, on the 17th and 18th; and 26·5° at Strelley, on the 18th. The thermometer on the grass recorded 18·2° at Strelley, on the 18th; 19·5° at Loughborough, on the 17th. Rainfall was slightly above the average, the totals reaching 3·97 inches at Henley-in-Arden, 2·91 inches at Coston Rectory, 2·69 inches at Strelley, and 2·35 inches at Loughborough. The amounts were not large, the collection being extended over a period of from 18 to 21 days. The weather was generally dull and damp. A lunar halo was observed at Loughborough on the 13th.

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Natural History Notes.

New British Fungi.—In this month (December) I have had the pleasure of finding, among others, two fungi belonging to a group hitherto little known in Britain, viz.: the *Gymnomyceteæ*. These two species were *Gymnomyces Ruber*, Van Tieghem, and *G. Reesii*, Baranetzky.—W. B. Grove, B.A.

A Neolithic Implement.—In the summer of 1884, a curious stone implement was found in the alluvial gravel of the Trent, at Carlton, about three miles north-east of Nottingham. It was found at the depth of about a foot in the alluvial plains half a mile from the present course of the river, by Mr. W. Stevenson, of Scarborough, during the progress of excavations there, and although it was dug up so long ago, no record of it has, I believe, up to the present time been made. I may, therefore, perhaps be permitted to make some mention of it here. The implement is about 12¼ inches in length, slightly curved, and thicker at one end than the other, being not much unlike a cucumber in shape. It is about seven inches in circumference at the end that is thickest, both ends being rounded, however, after the style of a pestle. The implement has evidently been ground and smoothed into its present shape, though it has suffered considerable surface disintegration since, and is pitted all over. It has been made apparently out of greenish grey metamorphic ash, resembling some of the Charnwood rocks and contains rounded crystals of quartz, a few minute fragments of purple slaty rock, and bits of greenish claystone. The implement appears to belong to the class of polished celts described in the sixth chapter of Mr. Evans's "Ancient Stone Implements of Britain," though it is not exactly like any that are there figured. Implements of this character, observes Mr. Evans, "are most numerously represented of all in collections of antiquities. There is great range in size and variation in form, though the general character is in the main uniform, among these polished implements." He divides them into four classes according to the section presented by the middle of the blade, thus (1) those sharp or but slightly rounded at the sides, &c., (2) those with flat sides, (3) those with oval section, (4) those presenting abnormal peculiarities. The implement in question, I should say, belongs to the third division rather than to any other. It resembles the lateral view of Fig. 66, more than any other given by Evans, except that it is round in section and more elongated compared with its diameter. This relic of Neolithic times is to be handed over, I understand, to the Natural History Museum, at Nottingham University College.—J. Shipman, F.G.S.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—Biological Section, Meeting December 8th.—Professor Hillhouse, M.A., in the chair. The Rev. H. Boyden, B.A., read a paper on "The Flora of the Rea Valley," in which he gave first a graphic description of the course of the river, the physical features of its valley, and its geological formation, and then went on to call attention to the leading characters of its flora, the rare plants he had

found, with their distribution. The paper, which was most interesting, was illustrated with an extensive series of flowering plants, ferns, and mosses, noticeable among which were *Sagittaria sagittifolia*, *Epipactis media*, *E. latifolia*, *Blechnum boreale*, and *Lycopodium clavatum*, a rare Midland plant, not before recorded from that district. Prof. Hillhouse made some very interesting and instructive remarks on the subject, and a discussion ensued in which Messrs. J. Morley, J. E. Bagnall, and others took part. Mr. J. Morley exhibited on behalf of Mr. S. Walliker the cast skin of a snake. Mr. J. E. Bagnall, A.L.S., exhibited for Mr. J. B. Stone, J.P., *Racomitrium atro-virens*, *Philonotis fontana*, and other mosses from Teesdale; from Dr. Braithwaite, *Leptodontium recurvifolium* from South Wales, and *Philonotis calcarea* from Teesdale; and an interesting series of plants from Colorado, U.S., collected by Miss Watkins, daughter of Mr. Leonard Watkins, late of this town; and an extensive series of rare plants from various British stations, with microscopical preparations to show modes of reproduction observable in mosses.—General Meeting, December 15th. Mr. R. W. Chase in the chair.—Mr. W. P. Marshall, M.I.C.E., gave his paper on "The Yosemitè Valley: its Geological and Botanical Features;" in illustration of which he exhibited various specimens of rock, granite, &c., and 120 plant specimens, besides maps and plans showing the outline, sections, and position of the valley. The paper, which will appear in the "Midland Naturalist," was much enjoyed by a large assembly of members.—Sociological Section.—At a meeting held in Mason College on the 3rd inst., Mr. E. F. Morley very effectively read Chapter IX. of the "Study of Sociology," on "The Bias of Patriotism." On the 17th inst., Professor W. Hillhouse, M.A., F.L.S., commenced the exposition of the Sixth and following chapters of Part IV., Vol. II., of Mr. Herbert Spencer's "Principles of Biology," on "Morphological Differentiation in Plants." The President, Mr. W. R. Hughes, F.L.S., Mr. W. B. Grove, B.A., and others took part. The subject will be completed on the next ordinary meeting of the section, on January 21st.

BIRMINGHAM MICROSCOPISTS' AND NATURALISTS' UNION.—October 19th. The discussion on "The Ice Age" was brought to a conclusion, Messrs. Rodgers, Insley, Hawkes, and Sanderson taking part.—October 26th. Mr. Beale exhibited two pipes and a pipe-head quaintly carved in a species of soap-stone, used as calumets or peace-pipes by the Dacotah Indians, also a number of arrow and spear-heads and knives in flint, chalcedony, quartz, quartzite, and jasper from the grave mounds in the Central States of America. Mr. Evans, a specimen of *Amphioxus lanceolatus*, a vertebrate, from the Mediterranean. Under the microscope, Mr. Tylar showed anthers of *Erica hyemalis*; and Mr. J. W. Neville, *Catenicella aurita*, an Australian polyzoon. A paper was then read by Mr. Beale on "How a Map is Made," which described the various instruments used, and the necessity of testing their accuracy before commencing the survey; also the importance of getting a good idea of the district from an elevated station. The whole district is then cut up into triangles, and every line between the various stations measured, and copious notes of every detail made in the field book. The process of plotting or drawing a map from the field book was described, and the necessity of exactness in every measurement, as the total of all areas added up must correspond with the district surveyed. The paper concluded by describing the difficulties of an urban compared with a rural survey.—November

2nd. Mr. Evans exhibited a polished rock from Lyme Regis, containing caudal vertebræ of Ichthyosaurus, and specimens of *Cyrena obovata* from the Mid. Eocene, Bentley. Mr. Moore, under the microscope, stomach and gizzard of beetle, *Colymbetes fuscus*; Mr. J. W. Neville, foraminifera, etc., from chalk washings.—November 9th. Annual meeting. The reports of the Secretary, Treasurer, and Curator were read and adopted. A hearty vote of thanks was passed to the President, Mr. C. Beale, C.E., who was re-elected for the ensuing year. Messrs. W. Dunn and J. A. Grew were elected Vice-presidents, and Messrs. H. Insley and P. T. Deakin, Hon. Secs. An address was delivered by the President. The speaker dwelt at length upon the utility of a knowledge of natural science, and the effect it necessarily has upon the formation of the character, giving a tone to the mind, and forming, without exception, a healthy and hopeful trust and faith in the power that formed and sustains the universe. The various sciences were passed in brief review, and their essential nature and specific work remarked upon. A resumé of the work of the year, and good wishes for the future, brought the address to a close.—November 16th. Mr. Deakin showed specimen of spider crab, *Maia Squinado* and *Portumnus puber;* Mr. Madison, specimens of *Limnæa reflexa* var. *exilis* from America; Mr. Evans, *Orthis Budleighensis* in a pebble from Moseley; Mr. J. W. Neville, several rough and polished specimens of "coal balls" from the Lancashire coal measures, a material unknown in our local coal-fields, and remarkable for the perfect preservation of enclosed plant remains. Under the microscope, Mr. Moore showed odontophore of *Zonites cellarius*, stained; Mr. Dunn, Nais worm; Mr. J. W. Neville, section of coal ball with transverse section of *Rachiopteris oldhamium.* Mr. Sanderson then read a paper on "The Yorkshire Dales." The writer regretted so picturesque a district was so little known, but thought the dialect spoken there might to some extent account for it. The paper described the geological features of the fells and dells, subterranean streams, the peculiar features locally known as "pots" and "pot-holes," and the abundant evidences of glacial action. The tarns were spoken of as beautiful in their loneliness, their silence only being broken by the cries of the snipe, lapwing, and coot. The paper concluded by surmising that the district was getting colder, from the fact that cereal crops were grown fifty years ago on sites that will not produce them now. The paper was illustrated by a series of photographs of the Whernside and Chapel-le-dale districts.—November 23rd. Mr. C. F. Beale exhibited a specimen of *Magilus antiquus*, a shell found among corals, &c., from the Red Sea. Mr. J. Madison, specimens of the following foreign helices:—*H. candicans*, *H. depressula*, *H. explanata*, and *H. muralis*. Mr. Corbet, fossil wood from Portland. Mr. Deakin, cocoon of puss moth, *Cerura Vinula.* Under the microscope, Mr. J. W. Neville, section of bone of cuttle fish, *Sepia officinalis.*—November 30th. Mr. Moore showed a collection of *Helix nemoralis*, including type specimens, and a large number of varieties. Mr. Hawkes, a collection of dried plants from South Africa, including a large number of heaths, and remarked that these plants were only distributed through Europe and Africa. Mr. Hawkes also exhibited a collection of plants from Llandudno. Under the microscope, Mr. J. W. Neville showed antenna of *Bombyx pernyi.* A paper was then read by Mr. J. Madison, "Notes on the Eocene," which explained the meaning of the name and described the situation of the beds in the London and Hampshire basins. The Thanet beds, Woolwich beds, London clay, and Bagshot series were passed in review, and their typical fossils enumerated, and the fine section at Alum Bay referred to for its richness in leaf

impressions. The writer concluded by hoping these beds would be well worked for the light they might throw on the origin of some of our land and freshwater shells. The paper was illustrated with specimens and diagrams.—December 7th. Mr. J. Madison showed a large specimen of *Paludina contecta*, also specimens of *Aviculopecten* from the coal measures. Under the microscope, Mr. J. W. Neville showed the sheep tick, *Ixodes reduvius;* Mr. Dunn, *Isthmia enervis* and *I. nervosa in situ* on alga.—December 14th. Mr. J. Madison exhibited specimens of the following land shells:—*Balia perversa*, *Vertigo antivertigo*, *Clausilia biplicata*, and *Testacella haliotidea*. Mr. Evans, a spine of fish, *Asteracanthus minor*, from Rhætic beds, Axmouth. A paper was then read by Mr. J. W. Neville on "Insects and Evolution." The writer regretted that this subject was so rarely judged on its own merits, from the difficulty of considering it apart from certain impressions with which we are all more or less associated. The life of an insect was described in its several stages and the evidence of evolution pointed out in each. It was held to be particularly strong in the embryonic stage where organs sometimes appeared for a short time and were then absorbed, and in the larval stage, where adaptation to circumstances had made a great variety of forms. The looper caterpillar was instanced as a remarkable departure from a normal form. Some loopers had come down to us without a remaining trace of six ancestral claspers, while others belonged, perhaps, to a more recent time, and the rudimentary claspers, from their stages of development, showed that they had been disused in pairs. The mouth organs of the imago were held to afford evidence of great modifications, if not of development, from a common origin. The paper was illustrated with drawings.

LEICESTER LITERARY AND PHILOSOPHICAL SOCIETY. —Section D, Zoology and Botany. Chairman, F. T. Mott, F.R.G.S. Monthly Meeting, Wednesday, December 16th; attendance seven (three ladies). The following objects were exhibited, viz.: By Dr. Cooper, a fine copy of Stevenson and Churchill's "Medical Botany," 1834, two handsomely bound volumes, the coloured plates of which were much admired. By Mr. W. A. Vice, a collection of fungi, chiefly on bark, as *Corticium*, *Nectria*, &c., and a curious specimen of the rather rare *Lentinus lepidens*, with its hard and solid stem curved into a semicircle. By the chairman, a copy of De Puydt's "Orchids," in French, with fifty fine coloured plates; a copy of Edgeworth's "Pollen;" drawings in pen and ink and pencil of hairs and epidermal cells of the sunflower, and of an unnamed orchid, from the island of Tobago, in the collection of J. G. Ward, Esq., of Belgrave; also a mass of petrified moss, from the Cropstone Waterworks, where a slight leakage of water, escaping through the masonry of a stone wall, carried lime, probably derived from the mortar, and deposited it on the moss on which it dropped. Some experiments were made in the measuring of heads and faces, according to the formulæ given by Mr. Smith in the December number of the "Midland Naturalist." Among the seven members present, one was dolichocephalic, five mesocephalic, and one brachycephalic; four were narrow-faced and three broad-faced; five were orthognathous and two hyperorthognathous. It was found that Mr. Smith had scarcely given sufficient details to enable learners to use his formulæ with certainty, and there appeared to be some printer's errors in the text. It would be interesting if Mr. Smith would revise and elaborate them.

ON THE VARIOUS CLASSIFICATIONS OF THE MAMMALIA.*

BY F. T. MOTT, F.R.G.S.

SYSTEMS of classification may be more or less natural, but can never be entirely or completely so. Nature knows nothing of our definitely limited orders, genera, and species. The actual plan of the universe is as much misrepresented by these artificial groups as the gallop of a horse is misrepresented by an instantaneous photograph, which fixes a momentary position but gives no idea of the graceful bounding movement as a whole.

A system of classification, as understood at present, resembles the instantaneous photograph in attempting to paint Nature as a man may see her. But the essence of her being is perpetual change, perpetual movement; and a human life is a smaller fraction of a cosmic cycle than the hundredth of a second is of the full stride of a galloping horse. What presents itself to our eyes, or to the eyes of successive individuals for a century, is only a passing phase. The phenomena were different yesterday; they will be different again to-morrow. Our senses are not delicate enough to register the daily change. Even in a hundred years we can scarcely recognise that Nature's hour-hand has moved by a hair's breadth. It seems to us, therefore, as if the forms we see around us were fixed and permanent; as if each generation precisely resembled its predecessor; as if species, genera, and orders had been created from the beginning just as they are, and would go on for ever unless extinguished by despotic power. From the days of Aristotle until those of Darwin—some 2,200 years—students of Nature were content with such views of her as they could get by the instantaneous photograph method. Observation, indeed, became gradually more complete, comparison and analysis more close and searching, but nothing was attempted beyond representing things as they appeared; there was scarcely any reference to what they had been, or what they would be.

The most modern systems are just beginning to take into account the past and the future, but a complete revolution in our ideas of classification is no doubt imminent. It is

* Transactions of Section D of the Leicester Literary and Philosophical Society. Read May 21st, 1884.

interesting and instructive, however, to study the development of thought in this direction during the past 2,000 years. It might be illustrated equally well by nearly every branch of natural history. I confine myself to-night to the Mammalia.

Within the scope of history the first man who studied biology as a science was Aristotle, about 350 years before Christ. He divided the Mammals into four orders, viz.:—Man, Quadrupeds with Claws, Quadrupeds with Hoofs, and Whales. For that period, and as a first attempt, this division was not unworthy of the wonderful genius of Aristotle. He saw that, as a matter of fact and science, man and the beasts of the field were inseparably allied; and his four orders were founded on correct though superficial observation. For nineteen centuries Aristotle was the one only great master and teacher of natural history in the civilised world.

There is no other notable name till 1550, when the German Gesner published an original work on zoology, in which he classifies the Mammals somewhat more elaborately than Aristotle had done. He divides the clawed quadrupeds into such groups as monkeys, dogs, cats, &c.; and the hoofed quadrupeds into horses, cattle, deer, &c. This was a step forward, but not a very large step, as the result of education for 1,900 years. A hundred years later (1650) came the Englishmen John Ray and his friend and colleague Willoughby. Their arrangement of Mammals did not differ much from Aristotle's, but they gave the name of Unguiculates to the clawed quadrupeds, and that of Ungulates to the hoofed ones; and these names have been universally adopted.

Yet another century brings us to Linnæus—about 1750. In his treatment of the Mammals he adheres to Aristotle's three great sections—of Unguiculates, with claws; Ungulates, with hoofs; and Whales, which he calls "Mutica," or creatures without claws or hoofs of any kind. He, for the first time, includes man with the clawed animals, instead of placing him in a separate division. His arrangement is:—

	ORDER.	
Unguiculates...	Primates...	Man, monkeys, bats.
,,	Bruta	Elephants, rhinoceroses, &c.
,,	Feræ	Dogs, cats, &c.
,,	Glires	Hares, rabbits, rats, &c.
Ungulates	Pecora.....	Oxen, deer, &c.
,, ...	Belluæ.....	Hippopotamus, horses, pigs, &c.
Mutica	Cete	Whales and dolphins.

Linnæus had a much clearer and more comprehensive notion of classification than his predecessors. He referred all divisions of one rank to one standard, and as, in botany he took the stamens as the standard of classes and the pistils as that of orders, so in the Mammalia he founded his primary divisions on the form of the extremities—whether clawed, hoofed, or unarmed—and his secondary divisions on the arrangement of the teeth. Among his Unguiculates, while the Primates have teeth of the three forms, molars, canine, and incisors, equally developed, the Bruta depend upon the molars, the Feræ upon the canine, and the Glires upon the incisors.

Fifty years after Linnæus came Cuvier, the great French naturalist. Freeing himself from the Aristotelian views, he studied the anatomy of animals, and founded a new classification upon the relationship of species in more fundamental matters than mere external organs. He divided the Mammalia into nine orders, viz.—

Bimana........	Man.
Quadrumana..	Monkeys.
Carnaria.......	Flesh-eaters: Cats, dogs, &c.
Marsupialia...	Marsupials: Opossum, kangaroo, &c.
Rodentia.......	Rodents: Hares, rabbits, &c.
Edentata......	Toothless animals: Sloths, &c.
Pachydermata	Thick-skinned animals: Horses, elephants, &c.
Ruminantia...	Ruminants: Oxen, sheep, &c.
Cetacea........	Whales, &c.

At first sight this does not seem very different from the system of Linnæus. But, in reality, although the names of the orders are still taken mostly from external organs and characters, the groups are much more accurately assorted, and two new ones—the Marsupials and Edentates—are established, whose anatomy is so distinct and remarkable that one wonders how Linnæus could have found place for them in any of his orders.

During the present century rapid progress has been made in comparative anatomy by such men as Owen, Milne-Edwards, and Huxley; and even Cuvier's system is now left far behind.

The arrangement adopted by Professor Flower in the new edition of the "Encyclopædia Britannica" makes eleven orders, distributed thus:—

Primates	Man and monkeys,
Carnivora	Dogs, cats, &c.
Ungulata.......	Hoofed animals: Horses, oxen, deer, elephants, &c.

Rodentia	Rodents: Hares, rabbits, &c.
Cheiroptera.....	Bats.
Insectivora......	Moles, hedgehogs, &c.
Cetacea	Whales, dolphins, &c.
Sirenia	Dugongs, &c.
Edentata.......	Sloths, anteaters, &c.
Marsupialia ...	Opossums, &c.
Monotremata ..	The Ornithorhynchus and Echidna.

In this arrangement physiology and anatomy have been largely aided by the modern sciences of palæontology, the study of extinct and fossil forms; embryology, the examination of the young in their progressive stages; and histology, the microscopic investigation of tissues. Yet it is still but an instantaneous photograph of Nature as she appears at a given moment, and makes no attempt to represent the stream of Mammalian life in its entirety.

About the beginning of this century a curious system was propounded by Mr. Macleay, and adopted by the naturalist Swainson. It was called the quinary system, the idea being that organic nature consisted of a network of circular groups, related to each other by affinities and analogies in a very complicated manner. There is a certain attractive truth in this idea, but the system based upon it was too rigidly mathematical for Nature's work, and could not live in the broadening light of science. Swainson and his followers maintained that the organic world was dominated by the number 5. That the ideal genus had 5 species, the ideal family 5 genera, the ideal order 5 families, and the ideal class 5 orders. To the class Mammalia they assigned the five following orders, and attempted to show their symbolical relationship with the 5 orders of Birds, and in the same manner with the Reptiles, Fishes, &c:—

MAMMALIA.		BIRDS.
Feræ	Carnivorous	Raptores.
Primates	Omnivorous	Insessores.
Glires	Frugivorous	Rasores.
Ungulata	Moisture-loving	Grallatores.
Cetacea	Aquatic..................	Natatores.

Swainson's works were published fifty years ago, and are now little known or read, but they are full of suggestive thought and well worth referring to.

If ever we are to break away from the instantaneous photograph method, if ever we are to take a broader view of classification, to get a more comprehensive grasp of Nature as a whole, it must be by tracing the lines of blood

relationship far back into the past, showing by what steps each group has reached its present position, and how it is related to its neighbours by descent and by cross-breeding; showing also how the force-waves, whose courses are represented by these material groups, tend always to rise to a climax and decay, and indicating the position of each group in the cycle of its own wave, whether in its ascending or descending phase, at its climacteric, or extinct.

Such a picture of Nature would be immensely more true, more interesting, and more instructive than the instantaneous photograph. At present our knowledge of the past is too fragmentary for any such picture to be drawn except in roughest outline, but knowledge is accumulating fast, and probably the present method of classification will be as antiquated fifty years hence as Aristotle's is now.

ON THE OCCURRENCE OF FOSSILIFEROUS HÆMATITE NODULES IN THE PERMIAN BRECCIAS IN LEICESTERSHIRE,

TOGETHER WITH SOME ACCOUNT OF THEIR ECONOMIC VALUE, &c.

BY W. S. GRESLEY, F.G.S.

(Continued from page 8.)

3.—We will next notice one or two rather remarkable features possessed by individual specimens,—forms which are very uncommon in hæmatite such as we are considering. 1. A porphyritic or coarse gritty combination of hæmatite and quartz, &c.; the latter occur in various stages of decomposition or transformation of silica into peroxide of iron, and are of various colours, viz.: transparent, purple, yellow, pink, red, &c. This fragment has been cut through and polished. A few cavities are seen where the grains have been so rotten as to crumble away. The specimen is exceedingly hard; quartz will not scratch the irony portions. The wavy parts seem to indicate a gradual inflow or filtration of iron that has replaced nearly all the original matter in those particular regions. 2. Another very similar specimen contains minute pseudomorphous iron ore of soft texture and of red and yellow tints, exhibiting concretionary structure. These seem to have been formed in pre-existing hollows, originally occupied by some other mineral: the hæmatite with which the grains and inclusions are cemented together

is of two kinds,—a softish brown or yellowish material, and a compact steel-grey ore taking the usual polish. 3. A nearly whole nodule and one of great hardness, which exhibits on its weathered surface the fortification type of agate,—also indistinct traces of fossils. This is the specimen already mentioned as being magnetic at one point only. 4. A brown, rather hard, flinty-fractured, siliceous variety of the ore, exhibiting, as many of the specimens do when polished, grains or little shiny patches of siliceous (?) hæmatite disseminated through the mass. A small hollow in this specimen has a coating of mammillated fibrous hæmatite, with a lustre approaching metallic adamantine. 5. A very singular, if not unique, form of columnar structure, shown in Fig. 9, Pl. I. It is of very hard iron-black hæmatite (?) (manganite ?)—streak brownish-red, fracture clean to uneven, lustre dull, weathered surface, dark brown or like the majority of the nodules. It appears to be a fragment of a nodular mass of ore, but what the original size may have been is impossible to say. It shows signs of having been water-worn to some extent, and subsequently fractured at three different times. Upon the original or most weathered and water-worn (?) part of the surface no signs of columnar structure are seen, but from the different fractured faces of the lump it is evident that this structure extends in all probability through the whole of it. The columns vary between $\frac{1}{24}$ of an inch in width at one end of the specimen and $\frac{1}{48}$ at the opposite end, as seen in the figure. Some are four-sided, some have more sides, but, owing to weathering, the precise forms are not readily distinguishable. The wavy formation is especially curious. This specimen is magnetic and possesses polarity, the poles being situated at right angles to the axes of the columns. There are no traces of fossils upon it. It takes a good polish, and is very heavy. Again, we occasionally find enclosed in lumps of the most compact blue ore, small streaks or spots of bright red powdery ore. Less often, specimens, when cut and polished, exhibit minute branch-like veins of bright compact metallic iron running through a body of ore of much more earthy character. These may be looked upon as veins of "segregation" or "exudation" in miniature. Very rarely nodules are found containing cavities lined with groups or bunches of crystals of calcite, &c., one-quarter of an inch in length, sometimes encrusted or rendered partially pseudomorphous with a light brown irony mineral. Other hollow nodules contain a globular aggregate of soft rounded grains, resembling roe, of a brown tint.

4.—*The Origin of the Hæmatite.*—Having described in general terms the leading features of these nodular fragments—namely, what they are, where they occur, whence derived, contents, both inorganic and organic, and other points, I will now endeavour, firstly, to show that there appear to me to be two ways of accounting for their *origin;* and, secondly, to state my grounds for accepting one in preference to the other, as being more in accordance with observed facts.

It has been shown that these stones have been derived from, or occur *in situ*, in the brecciated conglomerate of the Permian series. From the character of the rock fragments, of which these beds are to a great extent composed, we naturally conclude that they were deposited at no great distance from a shore. The rock fragments are said to represent rocks from the West of England of the Silurian and carboniferous series. Professor Hull seems to have regarded the deposits as "marginal," and Mr. Harrison says* they were formed along an old coast line, and were not brought from Wales as Sir A. C. Ramsay has supposed.

There are also the following facts before us:—That the nodules are to some extent water-worn; that they have been subjected to a considerable amount of rough treatment—abrasion, scratching, squeezing, &c.—before (?) coming to rest in the breccias; that they present a great variety of forms, quality, mineral composition, and so on; that they are of carboniferous (coal measures) origin or age, and therefore derivative. Now, do we find deposits or lumps of hæmatite in the coal beds of similar characters as these? The writer knows of none. Hæmatite, however, does occur occasionally in these strata. The following instances may be cited:—At Pontefract, Yorks, nodules of hæmatite are stated to occur in one of the uppermost beds of the coal measures.† In the Cumberland coal field, Mr. J. D. Kendall, of Whitehaven, writes‡ that in the upper coal measures, at Millyeat, near Frizington, hæmatite occurs in thin bands, interstratified with layers of clay or soft shale. This ore, in places, is as pure as any to be found in the district. In the Leicestershire and South Derbyshire

* See Proceedings of the Birmingham Philosophical Society. Vol. III., "On the Quartzite Pebbles contained in the Drift, and in the Triassic Strata of England," p. 187.

† See "Memoir of the Geological Survey of England and Wales, Geology of the Yorkshire Coal Field," page 757.

‡ See Transactions of the North of England Institute of Engineers, Vol. XXVIII., Part iii., 1879.

coal field, at Swadlincote, nodular red hæmatite (to be referred to in the sequel) occurs in the "blue binds" overlying the "fire-clay" measures. At a depth of 75yds. in the shafts of the Shireoaks Colliery, near Worksop, a seam of red ironstone (hæmatite) about 15in. thick was passed through. This is very high up in the coal measures of the district.*

A singular seam of red hæmatite exists in the lower measures of the Cheadle coal field, near to Leek, Staffordshire. At Torkington, near Stockport, it has been noticed; also at Beswick Lodge, and at Patricroft, near Manchester, In the coal field of Pennsylvania, U.S.A., hæmatite sometimes occurs interstratified with coal shales, &c.

Hæmatite and limonite almost always occur either in pocketty masses, generally in limestone (as in the Furness and Whitehaven districts, in Glamorganshire, Monmouthshire, Gloucestershire, &c.; in Sweden, at Dannemora; Bilbao, in Spain; Hartz, &c.), or in veins, as at Brendon, Somerset, in Cumberland, and elsewhere.

Why, therefore, may not our fragments and pebbles have had a like origin? Perhaps the presence of the *fossils* will be said to preclude the possibility of such an origin, as they are seldom found in masses of metallic minerals of this kind. Instances, however, are known of veins and pockets of metallic ore occurring in coal strata. How then are we to try to account for this seeming anomaly? I have suggested the following theory as a possible explanation of the origin of the stones in question. I admit that it does not in all points satisfactorily accord with all the observed facts. There is good reason to believe † that during the coal period certain tracts of land stood out high and dry above the general level of the then vast swamps, or forests, or coal-growing regions, now transformed into the British Isles and seas. Let us suppose that there existed at that time in the cliffs or sloping shores of this elevated tract, probably not very far removed from what is now the centre of England, natural open fissures or cavernous places, not dissimilar to those which we have upon our present-day shores, &c., the floors or wide cracks of which were just about on a level with the waters of the said coal-forming estuary or expanses. Conditions would thus be favourable for the leaves, twigs, and other parts of the then green things upon the earth obtaining access to such secluded spots, being brought thither by either wind or water. The fauna, too (mollusca, crustacea, worms, &c.), became dwellers in or visitors to these places. And let it be also supposed

* See Geological Survey Memoir or Quarter Sheet 82 N.E. p. 5.

† Quart. Jour. Geol. Soc., Vol. XII., p. 53.

that there went on, simultaneously with these accumulations in organic matter from without, a more or less regular inflow or deposition of iron, &c., derived possibly from a volcanic source (hot springs), or by percolation out of rocks containing much iron, situated at a higher level. But in whatever way the mineral did get into the place, it would, I imagine, be in a state of solution, and was gradually precipitated or deposited upon the bottoms and sides of the rocky openings in such a manner as to produce the various structures noticed in the fragments and organised nodules. The magnetic properties were possibly introduced during the progress of this formation, probably by electric currents set up along certain lines or cracks having some relation to a magnetic meridian. To account for the gritty and porphyritic varieties of the hæmatite we must presume that the enclosing rocks were partly composed of quartz—vein-quartz was probably there. Now the oxide of iron would naturally act upon the quartz, and to a greater or less degree actually replace it. In this kind of way we may, I think, reasonably conclude that the group of forms which seem to pass by insensible gradations from the ore of almost chemical purity to the very earthy kinds has been brought about. This state of things went on until the deposit of hæmatitic matter either filled the cavities in the rocks or a change of conditions came on which terminated it. The rest of the story is soon told. After a lapse of time (thousands of years perhaps), the tremendous earth-movements which bent and in other ways disturbed the coal measures and their surroundings, caused the breaking up of the deposit of hæmatite, and the waves obtaining access to its remains tumbled and rolled them about for long ages ; large masses of ice bore down upon them, crushing and breaking them still smaller, even to powder; and, lastly, having been thus shaped as we now find them, they became buried in a kind of clay or muddy mixture along with fragments of other rocks of probably more than one geological period, of older date than the coal measures.

The above theory is, of course, purely hypothetical. It is based solely upon negative evidence, and as such our readers will be able to draw their own conclusions. The chief objection to it I take to be—the external forms of many of the specimens, their even outline, and the character of the hollows, wrinkles, and cracks both upon the surface and in the interior of many. The source of the chief ingredient—iron—too, is extremely difficult to account for.

(To be continued.)

THE PRINCIPLES OF BIOLOGY.

BY HERBERT SPENCER.

Exposition of Part III. Chapter IV.

BY DR. WILLIAM L. HIEPE.

In the two first chapters of the third part, Mr. Herbert Spencer gives the general aspect of the theory of evolution, and contrasts it with the older belief in special creation. The next four chapters, which form the subject of our present discussion, are devoted to the investigation, how far certain zoological phenomena are in harmony with the evolution theory. These phenomena are those of classification, embryology, morphology, and distribution. So far from finding that these phenomena are not in harmony with the theory of evolution, we shall find that they cannot be satisfactorily explained by any other; that they follow as a necessary consequence from this theory, and they form, therefore, the basis of the most convincing and powerful arguments in favour of it. We shall now consider these arguments a little more in detail.

When we study the system of classification of the organic world, we find that the whole is divided into two main groups or kingdoms; animals and plants. Each of these main groups is divided into a number of secondary groups or sub-kingdoms. Each sub-kingdom into classes, and so on till we come to species and varieties. Calling, with Mr. Spencer, a division of high degree a group, and one of a relatively lower degree a sub-group, we find, further, that the differences which distinguish groups are great in degree and radical in kind, *i.e.*, they concern, as a rule, physiologically important organs. Differences of sub-groups are small in degree and do not concern important organs; in fact, they are often so small that it is impossible, or nearly so, to detect them. As an example, Mr. Spencer mentions the groups and sub-groups of the human species. The different nations which form the group of the Scandinavian races do not differ so much from each other as the whole of the Scandinavian races differ from the whole of the Celtic races. Again we find a greater difference between the northern races and the southern races, and finally we find the greatest difference between the largest groups, *i.e.*, the Aryan stock, the Mongolian stock, and the Negro stock.

We find the same with the different languages, from the most nearly related dialects to the widely different eastern and western languages. In languages we know that the

subordination of groups has arisen by evolution, and we have here, therefore, a very strong argument that in the creation of organic beings the same laws have prevailed. In the comparison between the division of organisms and that of languages we find yet another similarity. We find that in both the differences between members of the same group have not always the same value. For example, if we take several species belonging to the same genus, we may find some very much alike and others much more different. The same is the case with orders of the same class, with classes of the same sub-kingdom, and so forth; likewise we find in languages that dialects of the same language differ in a variable degree from each other, as also the different languages belonging to one group, &c.

Another strong argument in favour of the evolution theory is derived from the fact that allied groups of animals or plants show their relation most by resemblances of their lowest representants. When you compare the species of one group with those of an allied one, you find the greatest difference in the most modified and specialised, whilst the simplest and least changed forms will show a greater similarity. Now that is exactly what follows as a necessity from the theory of evolution. Two groups which are allied will by descent and divergent modification give rise to a number of sub-groups, and it is in the least modified members of each sub-group that we should look for the most numerous points of similarity, which, as we have seen, is actually the case.

With these facts and the different analogies between languages, known to have arisen by evolution, and organisms, we must come to the conclusion that the latter, too, have been produced by a process of evolution, and the truths derived from classification form at least a very strong argument in favour of that conclusion.

THE MIDDLE LIAS OF NORTHAMPTONSHIRE.

BY BEEBY THOMPSON, F.G.S., F.C.S.

PART I.

(Continued from page 23.)

To the north and north-east of Watford there are very few Middle Lias Sections to be seen. Of those mentioned in the "Memoirs of the Geological Survey," I have only been able to find one, that at Elkington. A little north of Elkington a

sandy marl may be seen forming the bank of a stream, but little can be now made of the section; it has yielded *Rhynchonella tetrahedra*, and so probably belongs to the "*Spinatus*" *Zone*, though the hard bed over which the stream runs belongs, I believe, to the "*Henleyi*" *Zone*.

At MARKET HARBOROUGH there are two brickyards in which the Middle Lias clay is used; the one in the town shows the following section:—

SECTION IN MARKET HARBOROUGH.

	About Feet	In.
1.—Soil	1	6
2.—Light blue or grey clay, containing some mica. Thickness varies owing to inclination of beds	8	0
3.—Band of concretionary ironstone, upper surface sharply defined, but not the lower, containing: *Belemnites*, *Gasteropods*, *Pecten æquivalvis*, *Protocardium truncatum*, *Terebratula*, &c. ...	1	0
4.—Light coloured clay, similar to (2). No fossils seen	5	0
5.—Yellowish sandy shale	1	0

The beds have a general inclination to the S.S.W., but it is variable in amount. The identity of beds 2 to 5 in this section, with 4 to 7 in the one below, is, I think, very evident.

SECTION NEAR TO MARKET HARBOROUGH RAILWAY STATION.

	Feet	In.
1.—Soil and Boulder clay	2	0
2.—Brown clay	5	0
3.—Ironstone band, containing concretionary ferruginous nodules, and many fossils	0	6
4.—Light blue and brown clay	7	0
5.—Ironstone band, similar to (3)	6 or 8 inches	
6.—Clay, similar to (4)	3	0
7.—Yellowish sandy shale, micaceous, and containing: *Ammonites margaritatus*, *Protocardium truncatum*, *Lima acuticosta*, &c.	1	0
8.—Clay, the character of which could not be seen owing to water covering it.		

The ironstone bands contained the following fossils:—

Belemnites, *Myacites unioides* (*Pleuromya costata*), *Pecten æquivalvis*, *Ostrea cymbium*, *Astarte striato-sulcata*, *Protocardium truncatum*, *Rhynchonella tetrahedra*, *Terebratulæ* (rather abundant).

And the Clay-beds below contain about the same fossils, but the material is so soft that they are difficult to get out whole.

I think beds 3, 4, 5, and 6 must be regarded as belonging to the "*Spinatus*" *Zone*, and 7 and 8 to the "*Margaritatus*," using the *brachiopods* as indicators. This course of using the *brachiopods* seems to be the best in Northamptonshire, where the characteristic ammonite of the "*Spinatus*" *Zone* is almost entirely absent, and *A. margaritatus* not very abundant nor having well-defined vertical limits.

On comparing the section given above with Prof. Judd's "Geology of Rutland," page 76, I think I must conclude that the laminated ferruginous sandstone, which he thought represented the Rock-bed, is worked out; there seemed to be nothing like it on the occasion of my visit. In other respects the section seems to have changed considerably.

We have so far been considering sections situated near the westerly limits of the Middle Lias outcrop; there are several others within the Middle Lias area that are worth noticing, and first let us take the one at Badby. This section I have found rather puzzling, for under undoubted Upper Lias, and where I expected to find the Rock-bed, was a bed containing a number of Rock-bed fossils, together with others that I had usually looked upon as characteristic of lower beds, so that the following arrangement is given provisionally.

Section, East of Badby.

1.—Soil, passing into a light-coloured marly clay containing many little *ammonites*. Communis-beds ... . 2 to 3

2.—Cephalopoda Bed, fragmentary, nodular, containing:—*Ammonites communis*, &c., *Belemnites*, *Lucina Bellona*, *Aviculæ*, *Serpulæ*, *Pentacrinite joints*.

3.—Transition-bed. In one spot, between the Cephalopoda-bed and Rock-bed, there is a thin patch of soft stone, containing an immense number of dwarfed *gasteropods* and other fossils—at least twenty species of fossils were obtained—and this I have very little doubt represents the Transition-bed.

4.—Rock-bed, a thin layer of highly-fossiliferous stone capping, and passing without any break into the next bed, containing:—*Pecten liasinus* (rather large and abundant), *Ostrea cymbium*, *Plicatula sp.?* *Terebratula punctata*, *Terebratula Edwardsi*, *Rhynchonella tetrahedra*, *Rhynchonella fodinalis*.

5.—HARD-BED, much thicker, but not nearly so fossiliferous as 4, containing:—*Belemnites* (fairly plentiful), *Cryptænia consobrina*, *Pecten æquivalvis*, *Pecten textorius*, *Ostrea*, *Modiola*, *Protocardium truncatum*, *Pholadomya ambigua*, *Monotis papyria?* *Astarte striato-sulcata*, *Cardinia sp.?* *Pleuromya costata*, *Terebratula punctata* (a few), *Rhynchonella tetrahedra* (one large specimen), *Pentacrinite*.

The last four beds occupy about four feet altogether, and, judging by the nature of the fossils, there seems to be here a fusing together of two or three of the hard beds of the Middle Lias. The Rock-bed a little more than a mile to the west of this has its normal characters.

It is probable that the great "fault" which extends so far along the Nen Valley, and cuts out the Middle Lias entirely at WEEDON, less than four miles away, commences near Badby, and has allowed the elimination of the upper Clay-beds and almost the Rock-bed there, as it has allowed the entire destruction of both hard and soft beds further eastward. It is necessary for me to mention, however, that about a third of a mile further eastward there is a shallow pit showing a ferruginous shaly rock, dipping at an angle of five degrees northwards, and containing:—*Belemnites*, *Pecten liasinus*, *Terebratulæ*, and a good amount of *Calc-spar*, which seems to be the Rock-bed.

Of the numerous Marlstone quarries that formerly existed south, east, and north of Badby, few remain; and these few are very insignificant. A little of the Rock-bed with a capping of Upper Lias may be seen to the north of PRESTON CAPES. Between DODFORD and NORTON, two or three sections of the Rock-bed may be still seen; one just to the north of Dodford yielded the following fossils:— *Belemnites*, *Pecten liasinus*, *Pecten æquivalvis*, *Plicatula spinosa*, *Rhynchonella tetrahedra*, *R. tetrahedra*, var. *Northamptonensis*, *Terebratula punctata*. The other sections are very similar.

The neighbourhoods of BUGBROOK and ROTHERSTHORPE have been very good ones for the study of the Marlstone, the Rock-bed has been extensively worked, and it is very fossiliferous, but there is not one good section near these villages now. On Ward's Farm, at a point about three-quarters of a mile to the south-east of Bugbrook, near to the canal, there is a shallow pit. The rock is very ferruginous, and red or green, according to the amount of weathering it has undergone, and a good many of the common fossils can be still obtained, *Rhynchonella tetrahedra* being particularly

abundant. The following were also obtained :—*Belemnites, Pecten dentatus, Pecten liasinus, Lima punctata ?, Rhynchonella tetrahedra*, var. *Northamptonensis*.

The Rock-bed around Bugbrook is so little below the surface that it can be seen in several of the ditches; this is the case in a lane just to the east of Bugbrook, and again in the lane to the west of the church. At this latter spot the bank is rather high, and the Marl-stone is capped by several feet of Upper Lias clay, in which one of the Cephalopoda-beds may be seen. On the south side of the railway and canal, near to the 66th mile-stone of the railway, there is a small quarry, or perhaps, having regard to its present condition, I should say a pond, where the Rock-bed may still be found; the upper portion of the bank is in the Communis-beds of the Upper Lias. In the village, a heap of stones yielded, amongst a number of common Rock-bed fossils, *Ammonites acutus, Eucyclus concinnus*, and *Actæonina Ilminsterensis*, from which I inferred that the Transition-bed was developed in the neighbourhood, although I had not been fortunate enough to discover it.

ROTHERSTHORPE now yields nothing, every quarry has been grassed over, but I may mention that a large proportion of the Middle and Upper Lias fossils that were collected by Miss Baker—sister to the Northamptonshire historian—were collected here. They are now distributed in various museums over the country, many being in the Natural History Museum at South Kensington.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.

PRESIDENT'S ADDRESS.

BY T. A. WALLER, B.A., B.SC.

(Continued from page 17.)

In the same region occurs the rock which has furnished the material for what will, I think, prove another investigation of primary importance for the coming geology, viz., that of Mr. J. J. H. Teall into the changes, chemical and mineralogical, which have been effected in a dyke traversing the gneiss

of Sutherland. The paper on the subject was read in December, and will not, I suppose, be published in full till May, but abstracts have appeared, and Mr. Teall has very kindly shown me sections from the different parts. The result may be broadly stated to be the transformation of an ordinary plagioclase-augite rock, similar in general character to the Rowley stone, with a hornblende-schist scarcely, if at all, distinguishable from that of, say, the Lizard district. This appears a startling assertion, but the details are so worked out that there seems no possibility of doubt on the matter. A curious circumstance is that the process has so gone on that the parts of the rock which are most nearly unaltered have the most altered appearance. There is a good deal of alteration in the felspar and augite, and the general aspect is rather of that unsatisfactory stage in the history of a rock when the constituents have become too full of apparently dusty opaque material to be properly transparent in thin sections. The next stage shows us hornblende in well-developed crystalline masses taking the place of the augite which proportionately disappears, and in place of the felspar there comes into notice a granular crystalline mass which seems to contain both quartz and felspar. Where this has gone on to the full extent the original constituents have completely disappeared, both as to substance and form, which latter in many cases of change remains after the substance is completely altered, but the rock is still quite devoid of any schistose structure; it might be classed as a diorite containing quartz. In certain parts, however, the freshly-arranged mass has become involved in some of the great earth movements, of which mention has several times been made, which have been such potent factors in the formation of the highland region, and here the crushing has resulted in the production of the hornblende schist with well-marked layers of hornblende in a colourless ground of grains of quartz and felspar. Chemical investigation shows that there has been comparatively little removed or added, and we seem to have at last traced a case of what has often been suspected, what indeed has seemed probable, a series of changes not of substance but of arrangement; the production of what has always been held to be a metamorphic rock, but out of an igneous not out of an ordinary sedimentary one.

This case shows very conclusively how considerable an amount of molecular mobility there is in the silicates in presence of water, even at comparatively low temperatures; and prepares us for the very low temperature at which it seems almost certain that the granites have finished their

crystallisation. The matter seems to have a very important bearing on certain points in the nomenclature of rocks. Ought such a mass to receive different names in its different parts, or should it all be called by the name descriptive of its original state. In this case, where proof is at hand, it is easy to call the rock both massive and schistose, an altered dolerite; but how are we to do with cases where there is no certainty of the kind? Very frequently the probability is very great that something of the sort has gone on. I may mention the cases of rocks from south Devon, Dolgelly, and Arran, which I have examined; and indeed one of the rocks from Nuneaton has a very suspicious appearance. A recent writer on the other side of the Atlantic, however, answers unhesitatingly that the original state of a rock is that which should give it its name; and he expresses his hope that the name diorite may soon be dropped as being only an alteration product of the plagioclase augite rocks, which he classes together as basalt, stating his conviction that hornblende is not a product of consolidation from fusion, but of changes subsequently induced; meeting such cases as the hornblende in the andesites and trachytes by the proposition that it is only what is left of a previously altered rock on being melted up. That hornblende is the result of processes which differ from simple crystallisation by the cooling of a molten mass at ordinary pressures is very probable indeed, as shown by the experiments of MM. Levy and Fonqué, which I mentioned last year, but that it is not an orignal crystallisation product of a rock mass may well be doubted, when we consider how (1) it occurs so regularly, and apparently unaltered in syenites and some granites; and (2), that the argument from the failure of laboratory experiments would equally prove orthoclase and mica to be secondary.

The question as to the formation of minerals in rocks, and their subsequent changes, presents some interesting points when viewed from another direction. The mineral leucite only occurs, so far as is at present known, in the recent, or at most late, Tertiary-lavas; and the question naturally arises whether there have been old leucite rocks which, by change of arrangement, have lost their characteristic mineral. The crystalline form of the mineral has presented many difficulties. Apparently belonging to the regular or cubic system of crystals, it was found on examination in polarised light to possess feeble double refraction, and indeed to be twinned in a highly complicated pattern. Hence a grave doubt was thrown on its true position in the crystallographic system; and careful measurements seem to establish that it is really tetragonal,

but with axial proportions which make its planes approximate very closely to those derived from a cube. Recent observers, however, have found that by cautiously heating a slice of a leucite crystal there arrives a time when the double refraction, and therefore of course the twinning lamellæ, disappear, and the plate becomes singly refractive as a cubic crystal. At its time of formation, therefore, leucite is probably a cubic crystal, but cooling induces other conditions, and the crystal changes to accommodate itself to them. Orthoclase is another mineral which undergoes great changes on heating, though in this case the results as observed by ordinary means are not so immediately striking.

Closely connected with this most interesting subject is the grand work of Dr. Lehmann on the origin of the crystalline schists, with special relation to the Saxon granulite region. The schistose rocks of this district have of late been classed as Archæan, but the author of the work considers that they are metamorphosed Palæozoic sediments of which the metamorphism probably took place between the Devonian and Carboniferous periods, when the district was crumpled and upheaved. Among them, however, he traces various masses of gabbro, evidently eruptive, through their various changes of substance and arrangement, until they result in hornblende schists in just the same way as the Scotch dyke which I have already mentioned. Another important observation of Lehmann's is the increased quantity of biotite, as the rocks are followed inwards from the less altered slates and shales from which he considers them to have been derived. The magnificent atlas of plates which illustrate the work is not its least important part. The photographs, to the number of more than 150, represent typical hand specimens, and are, in many cases, either reduced in size, or of about the natural dimensions. Those which show the effect of pressure upon solid rocks, grinding them and making them flow, as if liquid, around the more intractable pieces, are strikingly like some examples which Professor Lapworth has on a microscopic scale from northern Scotland. The deforming of the felspar crystals which yet have survived the crushing is exactly similar to that which I have had the honour of exhibiting to the society in this room.

The meeting of the British Association in Montreal last autumn was one of those experiments of which the success is the great justification. Of the success there seems to be no doubt whatever, in spite of all the dismal prognostications which greeted the decision of the committee. The special facilities for travelling and the generous hospitality of the

Canadians induced large numbers of English men of science (and others) to cross the Atlantic, and our own society has already had experience of the benefits derived from the innovation. In the very country where the specimens in dispute were first found, and which still furnishes the best specimens, we might have expected the controversy as to the organic or purely mineral character of eozoon to have formed a conspicuous feature of the geological discussions. There seems, however, to have been a truce between the parties, both, I suppose, feeling their own case impregnable, and waiting for the discovery of new facts which shall unmistakeably put their opponents to silence.

The various geological problems of which I have spoken to-night show us, it seems to me, very clearly how necessary it is for us to keep our judgments very much in suspense even on questions which appear to us demonstrated almost to certainty. It seems frequently to be forgotten that after all many of these so-called laws are only the attempt to collect phenomena in some order which appears to us natural. The sequence of rocks in Sutherland appeared as regular and normal as possible, and on the strength of such observations Murchison and his followers were entitled to found the views which they held; what they were not justified in, as it has turned out, was the assumption that theirs was the only explanation of the sequence.

So perhaps I may say, with trembling at my presumption, it seems to be with what we are ordered to believe of evolution. That it is quite a probable explanation of certain phenomena is quite true, but that the supporters of it bring forward anything which can be called proof—I speak as one without the slightest special knowledge, having only that which can be derived from what may be called popular presentations of the subject—I fail to see. They say, it must be so, or, it is, which of course is final but not altogether satisfactory. That certain flowers, for instance, have developed their colours, &c., with special reference to the preferences of different classes of insects, which of course may be true, but which appears to me quite incapable of proof, and yet is asserted with the utmost certainty and appearance of infallibility. I should, perhaps, apologise for travelling so far out of the special subjects of my address, but it seems to me to arise somewhat naturally from the subjects treated of, and I simply ask that those who do not recognise the necessary truth of such speculations may enjoy that toleration which ought to arise from a feeling of our own proneness to error.

BARIUM SULPHATE AS A CEMENTING MATERIAL IN SANDSTONE.*

BY FRANK CLOWES, D.SC.

Bischof mentions instances of foreign sandstones in which the material cementing the sand grains together is barium sulphate, but it appears that up to the present time no such sandstone has been met with in the United Kingdom. Having learned from my colleague, Professor Blake, that opinions differed regarding the calcareous nature of certain New Red Sandstone beds in the neighbourhood of Nottingham, I undertook to examine the chemical composition of these sandstones.

At the spot in question the sandstone appears as two hills, known as Stapleford and Bramcote Hills, and in the intervening valley there is a pillar of rock called the Hemlock Stone. The hills are conical in shape; the Hemlock Stone is a mushroom-shaped pillar some twenty feet in height. Professor Blake visited the spot with me some short time since, and we procured specimens of the sandstone from different levels of the hills, and of the Hemlock Stone. One of these portions was placed in the hands of two senior students for careful analysis, with the result that the sandstone was reported to contain about thirty per cent. of barium sulphate. I have recently found that the whole of the sandstone specimens from the two hills already mentioned contain this sulphate in varying proportions, which are at present being determined with care, whilst some of the lower beds also contain calcium carbonate. Those geologists who collected their specimens from the lower portions of the Hemlock Stone would undoubtedly detect a carbonate by the ordinary test with an acid, and would therefore consider the sandstone to be calcareous; but if they had procured samples of the mushroom-shaped top of the stone they would have found no carbonate, and would have failed to detect by the acid test the true

* A Paper read before Section B, British Association, Aberdeen Meeting.

cementing material, which is barium sulphate. It seems probable that the protective cap of the pillar owes its comparative permanence against weathering action to the presence of a very large quantity of this almost insoluble sulphate.

In some of the sandstone beds the barium sulphate is very unequally distributed, forming a network or a series of small masses more or less spherical in shape: in such sandstone the sand grains between the sulphate streaks and patches is quite loose, the result being that the weathered surface presents a honeycombed or mammillated appearance. In one bed which caps the Bramcote Hill the barium sulphate is present in little isolated patches about the size of a hazel-nut, and the weathering of this sandstone accordingly yields little pebble-like masses of sand held together by the sulphate; this bed is accordingly usually described by the geologist as a pebble bed, although this name is not strictly appropriate.

I have attempted to detect some evidence of the way in which this barium sulphate has been introduced into the original sand-bed. It may possibly have been deposited together with the sand, but if this is its origin it has certainly undergone physical change, since it exists now in a firm, compact, and crystalline condition. It seems certain, therefore, that it has either been originally deposited from aqueous solution, or has been rendered crystalline by the slow percolation of a solvent liquid through the sedimentary deposit, or else that it has been formed by the action of water containing calcium sulphate percolating through sandstone originally cemented with barium carbonate.

This double decomposition between calcium sulphate and barium carbonate has been artificially carried out by Bischof, and the presence of calcium carbonate together with barium sulphate in some of the beds in question may indicate such an origin. With regard to the possibility of barium sulphate being deposited from solution, or being rendered crystalline by a solvent, it must be remembered that barium sulphate stalactites exist: the origin of these stalactites is undoubtedly similar to that of ordinary calcium carbonate stalactites, and one which I have recently examined consists wholly of the sulphate. I have also received sand-pebbles bound together with large and well-formed crystals of barium sulphate; and that such crystals have been deposited from solution and not from fusion has been demonstrated by Bischof almost beyond doubt.

THE MONUMENTAL BRASSES OF WARWICKSHIRE.

BY E. W. BADGER, M.A.

(*Continued from page 11.*)

ASTON. I.—*Thos. Holte, Esq., late justice of North Wales and lord of this town*, **1545,** *head lost, and wife Margery, with one son and two daus., Marg. inscr. pecul. Haines.*—This brass lies on a slab on the floor in the N. aisle of Aston church. Its length, to the outside of the marginal inscription, is 6ft., and its width 2ft. 3in. The effigies of Thos. Hólte and his wife are 2ft. long, those of the children about 8in. The inscribed plate beneath the effigies is 2ft. by 3in. Haines (pp. 29, 243) considers this brass and those at Coleshill, Hampton-in-Arden, Middleton, Whitnash, Solihull, and Shuckburgh to be the work of local artists.

At the four corners of the slab are the four evangelistic symbols, an angel for St. Matthew, a winged lion for St. Mark, a winged ox for St. Luke, and an eagle for St. John. The common use of these symbols in this position is supposed by some to be the origin of the well-known rhyme:

Matthew, Mark, Luke, and John
Bless the bed which I lie on, &c.

Between these symbols, on strips of brass, is the following inscription in black letter:

☞ Of yō charitye praye for th.... | soolles of Thomas Holte esquyer late Justice of North Wales and lorde of this towne of Aston And | Margerye his Wyfe wich Thomas | deceased the xxiii daye of Marche Anno dn̄i Mccccccxlv whose soolles God pardon.

Above the effigies, on a shield, are the arms of Holte, Az., two bars, or, in chief a cross pattée fitchée, of the second; impaling Willington, Gu., a saltire vaire, arg. and az.

Thomas Holte, whose head is unfortunately lost, is attired in the robes of a justice. Possibly he wore a coif, or close skull-cap. (Compare the brass at Middleton.) On his shoulders is a tippet and hood, under which is a cloak fastened on the right shoulder. Beneath this is a gown with wide sleeves. The last two were generally lined with a fur called minever, but there is only a faint suggestion, if any,

of this in the present example. The justice holds in his hands, which are raised in prayer, a scroll, the symbol of his office ; at his right side he wears a tasselled pouch or purse called a *gypcière*, attached to his girdle. His feet are encased in wide shoes.

Margery Holte wears the dress in fashion during the first half of the 16th century. Her head-dress is that called, from its shape, the kennel or diamond-shaped head-dress. It was a sort of bonnet having a round cap at the back, and in front long lappets which hung down each side of the face, and were supported by wires so as to form an angle over the forehead. In the present example there are additional lappets or streamers. The lady's gown is high-necked and has a deep pointed collar, and is confined at the waist by a belt with a metal clasp. The sleeves are very large, and are ornamented with two rows of puffs, four bands, and wide scalloped cuffs. The voluminous folds of the dress, and the way in which it is tucked up at the side, are marks of the style of a provincial artist.

Beneath the effigies of the justice and his wife is the following inscription in black letter :

**Thomas Holte here lyeth in graue, Jhū for thyn passion
On hym thou haue compassion, And his soole do saue.**

Under this inscription, on separate plates, are the effigies of a son in a gown like his father's, but without the cloak, and of two daughters attired like the mother. There is a poor representation of the brass in Dugdale (p. 879). Dugdale (p. 872) says that Thos. Holte "being a learned Lawyer and Justice of North Wales in Henry VIIIth's time, as also in Commission for the peace in this Shire the greatest part of that king's reign, wedded Margerie the eldest of the seven daughters and co-heirs to William Willington of Barcheston Esquire (a wealthy merchant of the Staple) who survived him, and afterwards became the wife of Sir Ambrose Cave, Knight. And by her he left issue Edward Holt, Esquire, which Edw. having had his education with Sir John St. Leger (then of Weoley Castle in Com. Wigorn,) as by his father's will appears, was in 14 Eliz. constituted one of the Justices of Peace for this County, and in 26 Eliz., Shiriff; and dyed 3 Febr. 35 Eliz."

Aston Hall was built in 1618 by Sir Thomas Holte, the grandson of the Thomas commemorated by this brass. It will be noticed that the effigy of Margery Holte was placed on the grave before her death.

II.—In the S. aisle, on the floor, is a large stone inlaid with four brass plates. The first is set diamond-wise, and is 15in. square. It bears the crest of Lloyd: out of a five-leaved coronet or, a demi-lion ramp. arg., and the arms of the same:—per fesse, sa. and arg. a lion ramp. counter-changed impaling Bridgeman, Sa., ten plates, four, three, two, one, on a chief arg., a lion pass. of the field.

Beneath this is a plate 18in. by 9in., bearing the following inscription:—

Here Lyeth the Body of *MARY*
Late wife of *ROBERT LLOYD*
Of *ASTON* in the County of *SALOP* Esq.
Eldest Daughter of Sir *IOHN BRIDGEMAN*
Of *CASTLE BROMWICH* in this County Baronett
Who departed this life the 25th day of August
A.D. 1689.

Below this is a third plate 18½in. by 9½in., inscribed:—

Here also Lyeth Inter'd the Body of Charlotte
Bridgeman, *one* other of the Daughters of S^r^.
Iohn Bridgeman of Castlebromwich *Baronet*
She Erected that Monument on the south side
of this *Chancel* in Memory of her Parents
She Departed this Life y^e^ 28^th^ day of August
1750 *in* the 76^th^ Year of her age

Close to the above is a lozenge-shaped plate, 14½in. by 12in., bearing the name Charlotte Bridgeman, and the arms of Bridgeman described above.

BARCHESTON. I.—*Hugh Humfray, priest,* 1530, *in academical dress. Haines.*

This effigy is in a side chapel; its length is 13in.; the inscr. is on a plate, 14in. by 3in., at the feet of the figure. The brass is in good preservation, no part of it being lost. Hugh Humfray is tonsured, his hair is cut short in front, but hangs down in bushy masses over his ears. He is vested in hood, tippet with a border, probably of fur, cassock, and gown. The last has wide sleeves edged with fur, and large side pockets, and was worn by M.B.'s and Scholars of Divinity. The collar and cuffs only of the cassock are visible. The hands of the effigy are raised in prayer, and are disproportionately large; the shoes are absurdly broad;

indeed, the drawing of the figure altogether is rough and coarse. The inscription, which is in black letter, is as follows :—

**Orate pro aīa hugonis humfray magistri
arcm̄ nec non in sacra scā theologie bacheler̄i
cuius anime propicietur deus. Amen.** [*quatrefoil, oakleaf*]

Translation :—

Pray for the soul of Hugh Humfray Master of Arts and also Bachelor of Divinity to whose soul God be merciful. Amen.

A similar figure will be found engraved in Haines' Manual, p. 85.

The living of Barcheston was presented to Hugh Humfray by Robert Throckmorton in 1503, and was vacated by his death in 1530.

II.—In the same chapel is a brass plate 20¾in. by 12in., with these arms :—Arg. on a chev. between three buglehorns sa. stringed of the same and garnished or, as many mullets of the last ; and beneath them this inscription :—

VIVIT POST FVNERA VIRTVS | EXVVIAS HIC DEPOSVIT FLAMOCHVS | COLBVRN, FILIVS JOHANNIS COLBVRN, E | NOBILI FAMILIA IN AGRO WARR ORIVNDVS | VIR FVIT MORIBVS INTEGERRIMVS, NEC NON FIDE | THESEIA QVIQVE SEMPER IN AFFLICTIS REI-PVBLICAE | STATIBVS REGIIS PARTIBVS CONSTANTER ADHAESERAT, | BELLICA LAVDE NVLLI SECVNDVS, INVICTVS MARTIS | ALVMNVS, QVI POST VARIOS VTRIVSQ. FORTVNÆ CA | SVS ET EXOPTATAM REGIS ET REGNI RESTAVRATIO | NEM 18° DIE DECEMB : AO. ÆTAT : SVAE 52 AO. DOMI 1664 CVM | INGENTI OMNIVM MŒRORE SPIRITVM EFLAVIT.

Translation :—

Worth outlives Death.

Here are laid the remains of Flammock Colburn, son of John Colburn, sprung from a noble family in the county of Warwick. He was a man of the greatest integrity, and of fidelity like that of Theseus, and one who in the troublous times of the State ever remained a firm adherent of the King's party, in military glory surpassed by none, an undaunted warrior, who after various changes of fortune good and ill, and after the longed-for Restoration of the King and Monarchy, expired on the 18th day of December, A.D. 1664, aged 52, to the intense regret of all.

(*To be continued.*)

NOTES ON THE ANKER VALLEY AND ITS FLORA.

BY JAMES E. BAGNALL, A.L.S.

During the past year (1885) much of my leisure time has been employed in investigating the Warwickshire portion of the Anker valley and working up its flora, and as there are many peculiarities connected with this, it may possibly interest some of the readers of the "Midland Naturalist" to see my record.

This district, to which I have been unable before to give time, forms the north-eastern border of Warwickshire, and is bounded on the north by Staffordshire, on the east by Leicestershire, on the south and south-west by the Sow Valley (a tributary to the Avon), and on the north-west by a portion of the Tame Valley proper.

The Anker originates from a confluence of small streams, the main stream rising in Ryton Gorse, near Bulkington, a stream rising in a pasture a little below Wolvey, which is also joined by one rising on Wolvey Heath; these streams unite near Wolvers Hill, and the amalgamated stream takes a northerly direction past Anker Bridge and Burton Hastings to Sunnyfields. Here its course becomes westerly through Attleborough fields and under both the Trent Valley and Coventry Railways. Near to the latter it receives on its left bank Griff Brook, a stream rising near Shilton Village and draining part of Bulkington, Bedworth, Griff Hollows, part of Arbury Park, and Chilvers Coton. Besides this, minor streams rising near Wigham and Hinckley in Leicestershire have entered its east bank. After its confluence with Griff Brook, the Anker runs through Nuneaton, where it is joined by a stream formed by the union of several brooklets draining Stockingford, Nuneaton, Gulley Common, and Ansley coal-field. The Anker now takes a north-westerly sinuous course through Weddington, Caldecote, Mancetter, and Wetherley to Fielden Bridge, near Atherstone, receiving on its left bank streams from Hartshill Hayes and Oldbury, and on its right bank a Leicestershire stream rising near Fenny Drayton, and a little above Wetherley its most important feeder, the River Sence. The Sence is entirely a Leicestershire stream rising in Charnwood Forest, near Bardon Hill, having a course of about twenty-three miles, and draining a wide extent of the flat land of Leicestershire, including part of Charnwood Forest, Gopsall Park, Twycross, Cadeby, Market Bosworth, and running through Sheepy to its confluence with the Anker, near Wetherley. By the courtesy of Mr. Mott of Leicester,

I have had a marked "Catalogue of British Plants" showing the plants enumerated from the Sence basin, by the late Rev. A. Bloxam, Rev. — Coleman, Mr. Mott, and his coadjutors in the Flora of Leicestershire, and all my notes from this district are derived from this source. The list shows a flora of about 650 species, many of them rare plants, and about 112 species and varieties not as yet seen in the Anker Valley proper.

The Anker, now a noticeable stream, continues its northerly course through Grendon and Grendon Park, where it is joined by a small stream rising in Twycross Fields. After leaving Grendon Park its course is diverted in a westerly direction towards Polesworth. Here the country becomes suddenly elevated, and we have a ridge of high land forming Hermitage Hill. This causes the Anker to take an abrupt northerly course, past Alvecote Mill; and then again westerly and north-westerly under Shuttington Bridge, through Amington and Bolehall, to its confluence with the Tame at Ladybridge, Tamworth; receiving in its course, on its left bank, Merivale Brook and streams from Baddesley Ensor and the surrounding district, and on its right affluents from Warton, Austrey, and Seckington.

The course of the Anker from its rise to its mouth is about twenty-five miles. It is everywhere a pretty stream, and for a considerable distance very brook-like in character, limpid and rapid, and calling to one's mind Tennyson's beautiful "Song of the Brook":—

> "I chatter over stony ways,
> In little sharps and trebles,
> I bubble into eddying bays,
> I babble on the pebbles."

The beauty of this stream has inspired the verse of one of her sons, the almost forgotten Michael Drayton, who was born at Hartshill, on the banks of the Anker, and who, in a pretty sonnet addressed to this river, thus expresses his appreciative praise:—

> "Clear Ankor, on whose silver-sanded shore,
> My soul-shrined saint, my fair Idea, lies.
> O blessed brook, whose milk-white swans adore
> Thy crystal stream, refinèd by her eyes,
> Where sweet myrrh-breathing Zephyr in the spring
> Gently distils his nectar-dropping showers.
> Where nightingales in *Arden* sit and sing
> Amongst the dainty dew-impearled flowers.
> Say thus fair brook, when thou shalt see thy Queen,
> Lo here thy shepherd spent his wand'ring years,
> And in these shades, dear nymph, he oft hath been,
> And here, to thee, he sacrificed his tears.
> Fair *Arden*, thou my *Tempe* are alone,
> And thou sweet *Ankor* art my *Helicon*."

On the banks of this river, too, at Atherstone, Nehemiah Grew was born and buried, his father having been vicar of the church there. He was secretary for many years of the Royal Society, and was, if not the first, one of the first botanists who gave attention to the anatomy of plants. His work, "Anatome Vegetabilium," which is illustrated by many plates, is a living monument to his fame.

The district is intersected by the Trent Valley, Leicester, Ashby-de-la-Zouch, and Coventry Railways, and by the Coventry and Ashby-de-la-Zouch Canals, both of which yield an interesting and characteristic flora.

With regard to the physical geography and geology of the district I can say little. The district is generally flat, but on the west side, about Hartshill and Oldbury, the country becomes elevated, the highest point being Oldbury Fort, where we have an elevation of about 500 feet above sea level. And anyone standing here will be rewarded, if the day be clear, with a very beautiful outlook. If he stands looking towards Leicestershire, on his right will be the extensive wood called Hartshill Hayes, and peeping over that he will see the steeple of the small church at Hartshill. In the valley below lies Mancetter (the *Manduessedum* of ancient days), and its quaint-looking square-towered church, that looks like a remain from the remote past; close by, the trim, modern, brand-new-looking Wetherley church, and in the valley the silver streak that indicates the bed of Drayton's "crystal stream." On the right lie the woodlands of Atherstone and Merivale, and standing on the Watling Street, the old-fashioned town of Atherstone; and right before him a wide stretch of land, fertile and sylvan, with numerous little villages and equally numerous churches dotted here and there throughout the stretch, the churches of Seckington and Austrey being most prominent; and away out in the distance lie the Alps of that district—Bardon Hill; and looking over this beautiful scene, with its woods and copses so frequently interspersed, one cannot but feel some sympathy with old Drayton, and concede that his *Tempe*, although it may not vie with the Thessalian valley, is a fair one, and one might for the time forget how the world has changed since Drayton's time, were it not that away out in that flat Leicestershire valley he sees in the dim distance a little silver-like puff of steam, which, owing to the distance comprehended in the view, travels on slowly nearer and nearer until at last he is able to make out all the details of the railway train, bearing its freight of human beings or mineral wealth; and he is suddenly called home to the fact that the world has wagged on, and that he is living in an age of improvements not even dreamt of in Drayton's days.

Extensive quarries of quartzite occur at Hartshill and Caldecote; these have been made greatly interesting by the important discoveries of Professor Lapworth and Mr. Harrison. The rich Warwickshire coalfields which, lie mostly on the left bank of this river include those of Baddesley, Polesworth, Austrey, Hartshill, Griff, Nuneaton, and Bedworth, which yield not only their valuable mineral wealth, but also charge the atmosphere with dense volumes of smoke.

Permian rocks occur at Baddesley, rocks of the Bunter formation are seen at Polesworth, Bramcote Hall, and Warton, but the principal formation is that of the Upper New Red Sandstone, or Keuper. Calcareous beds occur near Bole Hall, but do not seem to in any way influence the flora. Red marl, white sandstone and conglomerate are to be seen near Marston Jabet and Warton, and in the latter village many of the fences and small houses are built of sandstone.

Although the district as a whole is well wooded, woods of any great extent are to be found only on the western side of the river. Here we have what may possibly be a portion of the remains of the old Forest of Arden, the more noticeable being Arbury Woods, Hartshill Hayes, the woods about Oldbury and Atherstone, Bentley Park, Merivale Park, Grendon Woods, and Birch Coppice. On the east side of the river the woods are usually little more than copses, Weddington Wood, formerly extensive, being now a thing of the past.

The woods are by no means prolific in woodland species, even such plants as the Cow-wheat, *Melampyrum pratense*; the Yellow Pimpernel, *Lysimachia nemorum*; the Pendulous Sedge, *Carex pendula*; the Wood Spurge, *Euphorbia amygdaloides*; the greater Wood-rush, *Luzula maxima*, being confined to woods about Bentley, Oldbury, and Arbury. Herb Paris, *Paris quadrifolia*, I have seen in Hartshill Hayes and near Oldbury in a spinney. The yellow Bird's-nest Orchis, *Neottia nidus-avis*, and Lily-of-the-valley, *Convallaria majalis*, both occur in Bentley Park. The wild Service Tree, *Pyrus torminalis*; Water Purslane, *Peplis portula*; the Pale Sedge, *Carex pallescens*; Wood Scorpion Grass, *Myosotis sylvatica*, are, I think, confined to Hartshill Hayes. The Wood Horse-tail, *Equisetum sylvaticum*; Great Horse-tail, *E. maximum*, occur abundantly in Bentley Park, the latter also sparingly in Arbury Park; the Wood Club Rush, *Scirpus sylvaticus*, has at present only been observed in Merivale Park; the Wood Small-reed, *Calamagrostis epigejos*, only in a thicket near Wolvey; the Service Tree, *Pyrus Aria*, near Weddington;

and the Purple-flowered Small-reed, *Calamagrostis lanceolata*, recorded by Kirk from near Griff, I have been unable to find; but the Millet Grass, *Milium effusum*, is more or less abundant in many of the woods. The Water Avens, *Geum rivale*, which occurs in the Sence Valley, has not been observed in any part of this district; many parts of Bentley Park seem likely to yield this and other such plants, but the incidental visits of a single season can scarcely exhaust the flora of so large a woodland.

(To be continued.)

METEOROLOGICAL NOTES.—December, 1885.

The barometer was high at the commencement of the month, but fell rather suddenly on the 2nd. A recovery of pressure soon followed, and the mean continued high until the 27th, when another fall took place, succeeded by a slight increase of pressure. On the 23rd, the mercury stood at 30·6 inches; the extreme range was, however, only 1·096 inches. Temperature has been about 2 inches below the average, the highest readings being 53·7° at Hodsock, on the 16th; 52·3° at Loughborough, and 51·9° at Strelley, on the 17th; 51·0° at Henley-in-Arden, on the 1st; and 50·5° at Coston Rectory, on the 17th. In the rays of the sun, 84·8° at Hodsock, on the 31st; 82·2° at Loughborough, on the 3rd; and 79·2° at Strelley, on the 17th. The lowest readings were 13·2° at Hodsock, on the 8th; 15·5° at Coston Rectory, on the 11th; 20·4° at Strelley, on the 8th; 21·0° at Henley-in-Arden, on the 11th; and 21·3° at Loughborough, on the 8th. On the grass, the mercury fell to 10·4° at Hodsock; 14·3° at Strelley, on the 11th; and to 16·7° at Loughborough, on the 8th. Rainfall was exceptionally small, the total values varying from 0·98 of an inch at Henley-in-Arden to 0·50 of an inch at Loughborough. Very little snow fell during the month. Sunshine was deficient. Lightning was observed at Loughborough on the evening of the 4th, and a lunar halo on the 21st.

Wm. Berridge, F.R. Met. Soc.

12, Victoria Street, Loughborough.

Natural History Note.

The Older Palæozoic Rocks in North-East Warwickshire.—Hearing that a shaft was being sunk in search of water half way between Chilvers Coton and Burton Hastings, by the Hinckley Local Board, I visited the place. The exact spot is a quarter of a mile south of the W in "The White Stone" on the Ordnance Map. The ground may be roughly estimated at about 325ft. above O.D. The shaft is stated to be 80ft. deep. The upper 60ft. or thereabouts is through red marls and white sandstones, apparently Triassic Waterstones; the lower 20ft. is in hard mottled blue and purple slaty shales.

They much resemble the well-known Cambrian shales of Griff Hollow and Stockingford, and possibly belong to the same formation. At the bottom of the shaft a bore hole is being made, which was already between 40ft. and 50ft. deeper in the same shales. The shaft is a mile and a half beyond the eastern edge of the Warwickshire Coal Field. The River Anker flows at about 50ft. or 60ft. lower level at a short distance to the north, and if its valley were carefully searched it is perhaps possible that outcrops of these ancient rocks might be found on the surface.—W. ANDREWS, Coventry.

ERRATUM.—I regret that, owing to a slip of the pen, the names of the fungi in my note on p. 25 are wrongly given, *myces* being used for *ascus*. The two species should be *Gymnoascus ruber* and *G. Reesii*, and the group Gymnoasceæ.—W. B. GROVE, B.A.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY—GENERAL MEETING, Dec. 1. Mr. T. Bolton exhibited the plasmodium of a myxomycete, in which the rhythmic movements of the granules and protoplasm were explained by Professor W. Hillhouse, M.A. Mr. W. B. Grove, B.A., read his paper on "New or Noteworthy Fungi," Part 3. The paper described about twenty species of Fungi found in this neighbourhood, many of them new to science, and all new or rare in Great Britain. It was illustrated by specimens, and portions of some of them, under the microscopes, also by carefully executed drawings showing their structure, &c.; among them were the following: *Mortierella polycephala*, a fungus on sphagnum; *Septocylindrium Chæto-spira*, *Helminthosporium Anglicum*, and *Catenularia simplex*, on dead wood, all new to Great Britain. MICROSCOPICAL GENERAL MEETING, Jan. 19.—Mr. R. W. Chase exhibited and described photographs of the two white-tailed eagles lately shot in Kent, which have been falsely represented in the newspapers as golden eagles. Mr. C. T. Parsons exhibited thirty-three specimens of fossil gums, from Africa, containing beautifully preserved insects; the specimens included animi, copal, and kowri. Mr. Clarke exhibited mounted specimens of *Holopedium gibberum*, from Grasmere. Mr. J. Morley exhibited a submarine hemipterous insect, of a new genus, *Æpophilus Bonnairei*, from the Channel Islands. Mr. W. B. Grove, B.A., exhibited *Lentomita ampullasca* (Cooke), a rare sphæriaceous fungus, and *Pachnocybe subulata*, on bark of sycamore, from Sutton; *Rhizomorpha subcorticalis*, between bark and wood of sycamore, from Sutton; and on a specimen of the same species, *Arthrobotryum stilboideum*, from Yorkshire, collected by Mr. Soppitt; also *Phoma complanata*, *Torula hysterioides*, from Sutton; and *Lophiotrema angustilabra*, from Middleton. Mr. T. Bolton exhibited a new arrangement for adapting the electric light to the microscope; also Messrs. Beck's cheap cardboard slide case, to hold 288 slides, for 8s. 9d.

BIRMINGHAM MICROSCOPISTS' AND NATURALISTS' UNION.—December 21st. Mr. Deakin exhibited specimens of scales teeth, and other fish remains, in carboniferous shale, from Pouk Hill Mr. Madison, specimens of *Sphærium ovale* from near Manchester Mr. Evans, a hermit crab, *Suberites domuncula*, in a case of silica

—January 4th. Mr. Tylar exhibited a specimen of gold ore from Los Angelos, California. Under the microscope, Mr. Hawkes showed a series of slides illustrative of the structure of the mistletoe.—January 11th. Subject, "Structural Botany." Under the microscope, Mr. Collins showed an anther lobe of mignonette; Mr. J. W. Neville, various moss fruits; Mr. Hawkes, aborted stamens of *Parnassia palustris*, pointing out their resemblance to the glandular hairs of the sundew. The former is said by Dr. Muller to be a plant that is giving up, or has given up, insectivorous habits.

LEICESTER LITERARY AND PHILOSOPHICAL SOCIETY. —Section D, Zoology and Botany. Chairman, F. T. Mott, F.R.G.S. Monthly Meeting, Wednesday, January 20th; attendance, thirteen (four ladies). The Chairman reported that a flock of siskins (*Carduelis spinus*) had been seen about Christmas time between Swithland and Cropstone, many of which had been captured by the bird-catchers with limed twigs, as they breed with canaries and make good singing mules. It is rather a rare bird in this county. The following objects were exhibited, viz., by Miss Grundy, a branch of butcher's-broom (*Ruscus aculeatus*), showing flower buds, from the New Forest, where it is called "Knee-holm," holm signifying holly, and knee, according to Prior, being derived through corruption and confusion from the Latin *cneorum*, which has no real connection with this plant; by Mr. W. A. Vice, several minute fungi on bark and dung; by the chairman, a piece of bark from the decayed bough of an elm tree, showing the radiating and sinuous tunnels of the larvæ of *Scolytus destructor* and the holes through which the perfect beetles escape. A very instructive and interesting address was delivered by Dr. Tomkins, officer of health to the borough, on "Microscopic Organisms in their Relation to Disease," describing the leading characters of the four principal forms Micrococcus, Bacterium, Bacillus, and Spirillum, and illustrated on the blackboard and by a series of admirable microscopic slides.

PETERBOROUGH NATURAL HISTORY, SCIENTIFIC, AND ARCHÆOLOGICAL SOCIETY.—December 31st. Botanical Section.—Chairman, Mr. J. W. Bodger. Five members present.—Mr. J. W. Bodger continued his address upon the tissues of plants, dealing more especially with wood structure, fibres, and vessels; exhibiting microscopically specimens of pitted, annular, scalariform, and laticiferous vessels; wood and bast fibres; together with transverse and vertical sections of various plants, to show the arrangement of the vessels, &c.—January 7th. Geological Section.—Chairman, Mr. E. Wheeler. Subject discussed—"Denudation" (Chap. VI., "Lyell's Student's Elements"). The various statements given in the chapter were considered, and the President illustrated the effects of what Lyell terms "Subaerial denudation," by the way in which rocking stones, &c., have been formed. It was thought a careful section of the Nene valley, in the neighbourhood of Peterborough, might show a somewhat similar section to the ideal one given on page 73, Fig. 81.—January 14th. Botanical Section.—Chairman, Mr. J. W. Bodger. Nine persons present. The Chairman gave an address on the "Epidermis and its appendages;" explaining the formation and mode of growth of the endophlœum, mesophlœum, and epiphlœum, the stomata, glands (internal), lenticels, hairs, prickles, papillæ, glandular hairs, stings, nectaries, and vittæ, illustrating the same with from fifty to sixty drawings and specimen plants, and by means of the blackboard.

A POSSIBLE ORIGIN OF ORGANIC LIFE.*

BY F. T. MOTT, F.R.G.S.

I have lately been reading a volume entitled "Natural Law in the Spiritual World," by H. Drummond. It would be difficult to find a richer mine of false analogies, and the argument is vitiated by them throughout; but the book is powerfully and brightly written, and is very suggestive.

The writer endeavours to show that as the inorganic cannot by any force inherent in itself rise to the level of the organic, nor the animal to the level of man, without a creative miracle at each step, so the natural man cannot become the spiritual man without a similar miracle. In analysing this argument one is struck by the fact that one step in the scale is omitted. It is not asserted that any miracle is required to lift a plant to the level of an animal, probably because the real genesis of the animal is almost within the vision of science at this present day. We find that the animal is not suddenly lifted above the plant by any miraculous intervention, but that the dog and the tree are the latest terms in two diverging series which converge, not as the animal and the human series do upon one distant point, but upon a line drawn from the upper regions of the far Past to the lower regions of the actual Present.

The conditions necessary for the existence of organisms which lie on the border land between the plant and the animal have continued from very early times and still remain, and there is sufficient evidence to make it probable that there was a time when all organic life was of this kind, and that the plant world and the animal world as we know them at this day have slowly developed from those germs in two distinct directions. A true analogy would suggest that the organic and the inorganic have arisen as two distinct kingdoms of Nature by a similar process—that the diamond and the tree are as truly the latest terms in two diverging series as the tree and the dog. But we cannot find in this case the point of convergence. If it ever existed, the conditions which made it possible seem to have passed away. We know of nothing of which it cannot be determined whether

* Read before Section D of the Leicester Literary and Philosophical Society, March 18th, 1885.

its place is in the organic or the inorganic series. Can we discover among the past epochs of which science reads the histories any one in which these two lines could probably have converged? What special characteristics must we look for in such an epoch?

In order to answer this question, we must consider, What is the fundamental difference between the organic and the inorganic? What is required to make the organic diverge from the inorganic? Their most fundamental difference lies in the fact that in an organism energy is more concentrated than it is in a crystal. In some sense the organic is to the inorganic as electricity to magnetism. The energy is more intense, the action more rapid and violent. When heat is communicated to an iron rod the molecules begin to move in a comparatively slow and feeble manner. As more of the heat-energy is concentrated in the iron some of these movements become more rapid. The iron glows with a red light. Then, as a larger number of the more rapid vibrations are set up, these mix with the slower ones and produce yellow light, and as still swifter and more violent vibrations are added by the concentrating energy the yellow gives place to white. If now this mixture of vibration-waves is analysed by the prism, the violet and the red diverge from a common point, and at a short distance the two rays are as far apart and as distinct in character as the organic and the inorganic kingdoms, and a mind which could recognise their differences without knowing anything of their origin might very well doubt whether one could have arisen from the other without a miracle. Yet these differences are due simply to the more concentrated condition of the energy in the one than in the other.

Now if we trace the creation of this world according to the very probable nebular hypothesis, we see that as the nebulous matter condensed, energy became more concentrated. This process continued until the ring became detached from the central mass, and until the ring itself became agglomerated into one glowing sphere. There was a period when the concentration of the energy reached a maximum, and a later period when dissipation became more rapid than concentration, and the active energy began to decline. Is it not possible that at the epoch of maximum energy such form was given to some material molecules, as differentiated their groupings and internal motions as much from the groupings and internal motions of others, as the violet ray is differentiated from the red? That a force-wave was established which has rolled on through the

ages since, whose climax is perhaps not yet reached, but whose material expression we recognise as the organic kingdom of Nature?

The epoch which gave it birth has long since passed away. No such conditions, nor anything like them, now exist within our cognizance. The change from inorganic to organic is therefore to us impossible. But we still find that the germs of life, those minutest organisms which have perhaps continued to reproduce their race with but slow and slight changes from those far distant periods, are capable of existing under what seem to us now very extraordinary conditions. They may lie dormant for long periods, perhaps for centuries resisting time and frost and drought. No heat short of the boiling point will injure them. We do not know what temperature would be required to kill them all, and we may well understand that if indeed their ancestors were born among the fires of this seething globe, when there was neither earth nor water, no heat which we can now apply would have affected them. It is indeed doubted whether protoplasm can in any case endure a degree of heat beyond the boiling point if once the hard cellulose of its protecting wall be penetrated. And it is an accepted doctrine that the cellulose cannot come into existence except as a secretion from pre-existing protoplasm, but we do not know that the heat which protoplasm will endure has *always been* limited to 212° Fahr. Its power of endurance seems greatly varied now. Many creatures are killed by heat of much less intensity than 212°. This limit may be a comparatively recent adaptation, the original protoplasmic germs having been adapted to absorb water not in its liquid, but in its gaseous form.

The progress of science reveals to us more closely at every step the continuity of the universe. The more we interrogate Nature the more loudly she answers that there are no gaps, no breaks, no miracles; that nothing is created; that everything *grows*; and that growth is the unfolding of hidden potentialities, the swelling of the waves of force which rise and fall and rise again in new combinations, each growing out of what went before; that organic life is only crystalline life under a new and more concentrated aspect, giving rise to more complex phenomena; that human life is the same in kind but on a higher level of concentration and complexity with self-consciousness as one of its special and most remarkable phenomena; that there are no doubt higher levels still to which concentrated force may attain, and that the self-conscious units may very possibly rise to the next plane by some increase of concentration, without losing that special attribute of conscious personality.

This is not a materialistic or an atheistic doctrine. The unfolding of potentialities implies that those potentialities already exist, and they are functions not of matter but of the immaterial force. The potentialities hidden in an acorn will mould its development into an oak, but nothing like that oak exists in the matter of the acorn. The moulding power is in the force-wave, of which the acorn represents the potential, and the oak the kinetic phase. And these force-waves can only be ripples of the one great central and eternal force-wave in which must co-exist all capacities and powers exhibited in the universe, including conscious mind and all which that implies.

ON THE OCCURRENCE OF FOSSILIFEROUS HÆMATITE NODULES IN THE PERMIAN BRECCIAS IN LEICESTERSHIRE,

TOGETHER WITH SOME ACCOUNT OF THEIR ECONOMIC VALUE, &c.

BY W. S. GRESLEY, F.G.S.

(Continued from page 37.)

Theory No. 2.—This requires far less appeal to the imagination than does No. 1. If we examine a typical series of the hæmatites side by side with a like set of nodules of clay ironstone (siderite or carbonate of iron), taken from the shales and clay beds of the coal measures, it will be seen that a great similarity exists in the two series. This resemblance is most marked in the external forms, dimensions, surface, and internal hollows, cracks, organic markings, and, in the case of a few, in colour, sp. gr. hardness, &c. It is in their structure, colour, lustre, and especially in their *weight* and *hardness*, that the greatest difference is to be observed. Specimens occur in the superficial deposits of the district whose derivation may, I consider, have either been the Permian beds or direct from the coal measures, they are so little altered. The colour of the surfaces, however, of these doubtful samples is some shade of red or brown. Why, then, may not these heavy, hard, steel-coloured, organised nodules and bits of ore be *altered coal-measure ferrous carbonates?* The only original thing about them is their shape (in the case of *whole* nodules). The mineral iron and the

enclosed fossils have also of course been in them from the first. We look upon them, in fact, as Pseudomorphs.*

Here are analyses of the two kinds of iron ore :—

CLAY IRONSTONE.†		HÆMATITE.‡	
Protoxide of iron	46·14	Ferric oxide............	95·77
,, manganese	1·40	Manganous oxide ...	·03
Alumina	3·53	Sulphur	·072
Lime	3·43	Silica	3·35
Magnesia	2·13	Loss on ignition, consisting of water and carbonic dioxide ...	·56
Carbonic acid...........	32·04		
Silica	8·63		
Water, &c.	3·04		
	100·34		99·782
Metallic iron......	35·95%	Metallic iron......	67·036%

The specific gravity of clay ironstone = 3·75
The specific gravity of the hæmatite = 4·62
The hæmatite was slightly polaric.

Granting that these stones were originally nodules and parts of beds or "measures" of coal-strata carbonates, their high sp. gr. shows that something has since entered into their composition ; and the variety of structures, densities, colours, magnetism, and so on, points to changes they have undergone—changes of great importance.

Perhaps if the stones are looked upon as the result of *chemical change* we shall be correctly describing them. At all events they may be termed *pseudomorphous*. "Paramorphous" § or pseudomorphs by paramorphism, is, I think, the best word to apply to them.

That the *change* or *alteration* above mentioned has taken place either in the breccia or before the nodules commenced their travels or were washed out of the coal-measure débris is evident. It does not seem possible that it could have been brought about during the removal and prior to the deposition of the stones in the Permians ; though we know nothing of the conditions they may have gone through, or of the length of time they passed through in a state of unrest. This, however, matters little, though further on I shall endeavour to

* Pseudomorph = *false form*. In mineralogy, "a mineral which has replaced another and has assumed the external form of the mineral so replaced." (Geikie.)

† A South Staffordshire ironstone.

‡ Analysis of Permian breccia pebbles by G. E. Harrison, Birmingham.

§ Paramorphs are certain pseudomorphs in which a change of molecular structure has taken place without alteration of external form.

show *when* this change probably did take place. The question is rather, *how* or in *what manner* did it take place? Water no doubt played the chief part. This, supposing it were charged with carbonate of iron or possibly with perchloride of iron, would percolate the Permian strata by occupying any crevices, joints, or other openings, staining the rocks red by precipitating or depositing iron all around. As hæmatite is found pseudomorphous after ferrous carbonate, the latter, in the shape of the clay-ironstone nodules, &c., would naturally combine with ferric oxide. Now this kind of process, or segregation, seems to have continued until all the original carbonate of iron had become changed into hæmatite; in fact, each individual nodule seems to have been a kind of centre of segregation, and taken up considerably more mineral matter than it originally contained, as evidenced by a comparison of their relative weights. The ferrous carbonates would, therefore, appear to have possessed, as it were, the power of attracting and absorbing or combining with the oxide of iron without increasing in bulk. But the most difficult point for explanation seems to be this:—What has become of the siliceous and aluminous materials of the original ore? The foregoing analysis shows that they hardly exist in the pure ore; and if, as I have supposed, the stones were once clay-ironstone, these earthy ingredients must have disappeared. The "Spotted Vein" clay-ironstone of Dowlais, Glamorganshire, is about the purest clay-ironstone I have heard of, if we may judge from the analysis given of it;* and even supposing that the Permian nodules were originally composed of an ore as free from insoluble matter as this Glamorganshire ironstone is, there still remains the difficulty of solving the problem. Now, I understand that as yet chemists have not been able to account fully or satisfactorily for the way in which the removal of the silicates of alumina, &c., can be effected from a clay-ironstone. In a paper read before the Royal Geological Society of Ireland, May 14th, 1873, by Mr. E. T.

* Silica and alumina	14·17
Peroxide of iron	76·61
Red oxide of manganese	1·21
Lime	3·13
Magnesia	3·96
Phosphoric acid	0·57
Potash	0·87
Sulphur	0·06
	100·58

See "Iron Ores of Great Britain," Part iii., p. 209.

Hardman (see "Geol. Magazine," Vol. x., p. 395), descriptive of some peculiar siliceous nodular brown hæmatite in the Carboniferous rocks in Co. Tyrone, an attempt is made, and some chemical formulæ are given, to show how by a complicated series of re-actions and so forth, it is perhaps *theoretically possible* to replace the siliceous and clayey materials by iron oxides, as he maintains the Tyrone nodules have been the result of some such chemical process. That rich red hæmatite has by natural chemical re-actions been produced, directly or *in situ*, from clay-ironstone is, however, a fact notwithstanding, as will be shown further on.

The various kinds of structure noticed would probably be due to change of molecular structure, though we must admit that one or two of them (stalactitic, columnar, and some of the agate forms) are difficult to account for. The agate-like markings are occasionally met with in certain kinds of dense hæmatites, and in these instances they probably do not represent original structures of the carbonates. What most puzzles me is the occurrence of magnetite (polarity) and the manner in which the magnetic iron exists in the nodules. The presence of some Fe O is probably connected with this peculiar property. The writer has not been able to learn that iron ore of this particular character has been found or noticed to possess polarity before. *How* and *when* this property was given them I must ask our electrical and philosophical friends to enlighten us if they can and will kindly do so.

I have yet to explain (under this second theory) how the intermediate or half-and-half forms of hæmatite and gritty sandstones, &c., were probably formed. And here it should be stated that the more closely these associated rock fragments are examined the less able are we to draw a line between the hæmatites and them. The same process that caused the conversion of the clay ironstones into iron oxide, viz., long-continued chemical action, I take it, produced these semi-hæmatitic specimens. They seem to show that the chemical change has not gone quite so far with them, quartz probably being less easily acted upon or replaced than clay ironstone.

In order to show that I uphold theory No. 2 in preference to theory No. 1, I will state a few additional facts and opinions having important bearing upon the questions involved.

We have been considering these nodules, &c., as pseudomorphous. During what geological period or periods the transformation took place I will now proceed to discuss. The fact of the stones being now obtained, or being derived

from the Permian breccia, does not prove that this change was effected during the Permian era; they might possibly have been converted into hæmatite in coal measure times, or during the continuance of one or more of the secondary periods—in fact, the gradual replacement may have gone on ever since the deposition of the breccias until these beds were denuded, and their contents scattered over the country. We shall be better enabled to fix the age or rather the beds in which this metamorphism took place, when we consider that the agate or peculiar concretionary markings are not solely confined to the fragments of hæmatite, but that they show themselves on the surface, within. and in joints of other pebbles and fragments of rocks of older date than the coal measures. In all these cases these concretionary markings seem to be the result of segregation of ferric oxide, produced through the action of water. The hæmatitic matter (red staining, coating, and replacing), not being wholly confined to the ironstone, but being present in greater or less quantity in other and older rock fragments, seems to show that the bulk of the ferric oxide present in each and all of these stones, both in and derived from the breccia of the locality, found its way into them during, or certainly not previous to, the Permian epoch.

Now this iron must have come from below, or from above, or along with the water and sediment, by whose agency the breccias were deposited, and in a great measure formed. That it did not come from below is evident; at all events I have no evidence whatever to support such a theory. That it came from above is by no means so uncertain. Water permeates downwards, and in so doing would part with its irony solution to rocks it passed over or through, thereby staining them. But although it is not perfectly clear that rocks of later date, containing iron that could be, or was, by water, dissolved out of and carried down into the Permians, ever existed all over the breccias containing the hæmatite, a study of the geology of the district leads to the conclusion that they did once overlie the whole of the breccias. These newer rocks are the Triassic series, whose well-known red colour is due to oxide of iron. Numbers of instances occur in this country of coal measures so thoroughly altered in colour by staining from superimposed Permian or Triassic strata as sometimes to puzzle greatly mining men and even geologists. In considering, then, whether the iron originated along with the breccia and was not derived from the Trias, we must look for Permians of the same red-stained character, which we can show were never at any time buried

beneath strata, as the Triassic, for instance, or where beds intervened between the red Permian and the red Trias, whose contents do not exhibit iron staining, and which we naturally suppose would have been so stained had such conditions obtained as those we have just been considering. In the lower divisions of the Bunter (the conglomerates and sandstones of the Leicestershire areas), we find comparatively little iron staining, and therefore I have come to the conclusion that the hæmatites, &c., have been formed from iron *from the first* in the Permians themselves. I have supposed that the waters of this remarkable geological period were deeply charged with iron in solution—carbonate of iron. (I refer to the Permian area of the Midland counties only.*) It might, however, be said in explanation of the way in which the iron became so abundant in the breccias, that as the coal measures lying immediately beneath them would, by reason of their argillaceous character, be practically impervious to water, and that thus arrested in its descent through the Triassic beds which are pervious, the carbonate of iron in solution would be carried down through, and probably out of those beds, and coming to rest upon the coal strata would there gradually be changed into an oxide of iron and act upon the breccias in such a way as during long ages would ultimately so alter the original character of its rock fragments as to make it very difficult for us to explain their previous history.

This question, viz., During what geological period did the alteration of the nodules take place? is, of course, a speculative one, and a point extremely difficult to prove, and until similar ironstones have been found *in situ* in the coal measures, the solution of this problem must, I think, remain *in statu quo*.

(To be continued.)

NOTES ON THE ANKER VALLEY AND ITS FLORA.

BY JAMES E. BAGNALL, A.L.S.

(Continued from page 58.)

One of the striking features connected with the flora of the Anker is the rarity or absence of heath-loving plants. And this because there is abundant evidence of the district having in former times been to a great extent moor or heath

* "Contributions to the Physical History of the British Isles," by E. Hull, M.A., F.R.S., &c., 1882, p. 91, and Plate VIII.

land, a continuation of that vast moorland stretching across the country through Fazeley, Middleton, Sutton Coldfield, to Cannock Chase and still further north. Mining, tillage, drainage, and other industrial operations seem to have completely changed the character of the country and its flora. But at Bentley, Baxterley, and Baddesley we have still remains of the old heath lands. Even here, however, as well as elsewhere in the district, plants usually common to such soils are either rare or absent; such plants as the Wood Betony, *Stachys Betonica*; the Bilberry, *Vaccinium myrtillus*; the Lousewort, *Pedicularis sylvatica*; the Sheep's-bit, *Jasione montana*; the Hawkbits, *Leontodon hirtus* and *L. hispidus*; Eyebright, *Euphrasia officinalis*; Sneezewort, *Achillea ptarmica*; Saw-wort, *Serratula tinctoria*; Thyme, *Thymus serpyllum*; Hawkweed, *Hieracium umbellatum*; Red Bartsia, *Bartsia odontites*; Sheep's Fescue Grass, *Festuca ovina*; Green-ribbed Sedge, *Carex binervis*, are most of them rare, and in some cases confined to limited spots in one locality. I have searched in vain for the Star-headed Sedge, *Carex stellulata*; Pill-headed Sedge, *Carex pilulifera*; the Cross-leaved Heath, *Erica tetralix*; the Cudweeds, *Filago germanica* and *F. minima; Myosotis versicolor*, and the Sun-dew, *Drosera rotundifolia*.

As a rule the cultivated lands of this district are remarkably free from weeds, and the plants which Mr. Hewett C. Watson designated "Colonists" are absent over large areas. Such plants as the Corn Cockle, *Lychnis Githago*; the field Crow-foot, *Ranunculus arvensis*; Shepherd's Needle, *Scandix Pecten-Veneris*; Dwarf Spurge, *Euphorbia exigua*, I have only found in one or two localities; the Stink Mayweed, *Anthemis cotula*, usually abundant in Warwickshire, I have only seen as an isolated plant near Shuttington; and the Knawell, *Scleranthus annuus*, in a field near Hartshill; *Chrysanthemum inodorum* and *C. Matricaria* are usually absent from the fields but occur in abundance on the adjacent footways and waste places. Poppies are noticeable for their rarity in the cornfields; and the Corn Marigold, *Chrysanthemum segetum*; the Corn Bottle, *Centaurea cyanus*, are apparently absent from the district; the Oat Grass, *Avena fatua*; the White Goosefoot, *Chenopodium album*; the Slender Fox-tail Grass, *Alopecurus agrestis*, are usually rare; whilst the Bent Grass, *Agrostis nigra*, is in some of the fields too abundant.

No marshes of any extent occur in the district, but there are marshy places about Baddesley, Shuttington, Atherstone, and Wolvey, and the predominating plants in these places are the Lady's-smock, *Cardamine pratensis*, the Fleabane, *Inula*

dysenterica, Marsh Cross-wort, *Galium palustre*, Bog Stitchwort, *Stellaria uliginosa*, and the Toad Rush, *Juncus bufonius*. The Marsh Violet, *Viola palustris*, occurs sparingly in a marshy bit near Atherstone; Marsh Valerian, *Valeriana dioica*, near Burton Hastings; the Impatient Lady's-smock, *Cardamine impatiens*, Hartshill; Water Dropwort, *Œnanthe fistulosa*, in about three localities; the Bitter Lady's-smock, *Cardamine amara*, Shuttington, Mancetter, and Burton Hastings. Grass of Parnassus, *Parnassia palustris*, Cinquefoil, *Comarum palustre*, the Bog Pimpernel, *Anagallis tenella*, the Penny-rot, *Hydrocotyle vulgaris*, the Butterwort, *Pinguicula vulgaris*, are not, so far as I have seen, to be found in the district. Blinks, *Montia fontana* is fairly frequent, and the Great Chickweed, *Stellaria aquatica*, is more frequent than in any other Warwickshire district.

Of plants usually found on hedge banks, waysides, and waste places, I find many that are noteworthy. The White Bryony, *Bryonia dioica*; Black Bryony, *Tamus communis*; the Dogwood, *Cornus sanguinea*; and the Privet, *Ligustrum vulgare*, are all widely spread through the district. The Buckthorn, *Rhamnus catharticus*, and Barberry, *Berberis vulgaris*, are both rare; the Alder Buckthorn, *Rhamnus Frangula*, and Spindle Tree, *Euonymus Europæus*, both appear to be absent; and the Guelder Rose, *Viburnum Opulus*, though rare in hedges, occurs in many of the woods.

The Hemlock, *Conium maculatum*, is abundant in two localities near Warton and Caldecote; the Teasel, *Dipsacus sylvestris*; Pepper saxifrage, *Silaus pratensis*; Rest Harrow, *Ononis campestris*, occur over wide areas; but the Goutweed, *Œgopodium Podagraria*, and Greater Celandine, *Chelidonium majus*, both usually abundant near our Warwickshire villages, are remarkably rare. The Hairy St. John's Wort, *Hypericum hirsutum*, and Bastard Stone Parsley, *Sison Amomum*, are both local; and the Greater Burnet Saxifrage, *Pimpinella magna*; Meadow Rue, *Thalictrum flavum*; Wild Basil, *Calamintha Clinopodium*; Meadow Geranium, *Geranium pratense*; Bladder Campion, *Silene inflata*; Tuberose Pea, *Orobus tuberosus*, are among the most rare plants of the district. And the following, all of which occur in the valley of the Sence, are absent from that of the Anker proper:—*Inula Conyza*, *Galium Mollugo*, *Chærophyllum Anthriscus*, *Pyrus communis*, and *Prunus Cerasus*. I also find *Arctium majus*, *A. minus*, and *A. intermedius* at wide intervals.

Ferns, with the exception of the Bracken, *Pteris aquilina*, which occurs throughout the district, are often absent over wide areas, and are usually represented by the

male fern, *Lastrea filix-mas*. The common Polypody, *Polypodium vulgare*, usually abundant on hedge banks in Warwickshire, I have only seen as a single plant near Weddington. The Maiden-hair Spleenwort, *Asplenium Trichomanes*; the Wall Rue, *Asplenium Ruta-muraria*; Mountain Shield Fern, *Lastrea Oreopteris*, all occur near Atherstone; the Prickly Shield Fern, *Aspidium aculeatum*, at Hartshill and Gulley Common; and in the woods at Bentley, Hartshill, and Arbury I find both forms of the Ladyfern, *Athyrium filix-fœmina*, *Lastrea dilatata*, *L. spinulosa*, and the noble-looking *L. Borreri*.

But however wanting the district may be with regard to rare plants, the student who pursues that most thorny and intricate study, the Brambles, will here find material enough and to spare, for in these plants the district is rich indeed, giving not only abundance of individuals but also wonderful variety; it is, in fact, the richest bramble district in Warwickshire. Fifty-one species and varieties have been observed by myself, and two, viz., *Rubus Grabowski* and *R. rubicolor*, are recorded by Mr. Bloxam, which I have not yet found.

Rubus Bloxamii, originally found in Hartshill Hayes by Mr. Bloxam, occurs not only in that wood but is also the prevailing bramble of the Hartshill quarries and lanes. *R. foliosus* is abundant on Ansley coalfield, in Hartshill quarries, and near Mancetter. *R. Bellardi*, *R. infestus*, *R. Guntheri*, *R. Lejeunii*, and *R. mucronulatus* are abundant in Hartshill Hayes, Parley Park, and Bentley Woods. A form intermediate between *R. ramosus* and *R. Lindleianus* prevails in the Hartshill quarries, in lanes near Wolvey, and near Anker bridge. Mr. Archer Briggs also finds this form, in Devonshire, abundantly. The true *R. ramosus* occurs somewhat abundantly near Shuttington. *R. rosaceus*, *R. villicaulis*, are abundant in Bentley Park and Gulley Gap; and in the district about Anker bridge and Burton Hastings *R. concinnus* and *R. pilosus* are the prevailing brambles. Beside these and many others I find in great abundance and at wide intervals a bramble which Coleman named *R. Bloxamiana*, a very noticeable plant, midway, I think, between *R. scaber* and *R. fusco-ater*, but at present undescribed in our English floras. In fact, any industrious student of these plants would find in this district most of the acknowledged species and varieties, and more than one not at present described in our text-books.

Of the genus Rosa I find *R. micrantha*, two forms of *R. tomentosa*, and twenty-four varieties of *R. canina*, but as a rule both *R. tomentosa* and *R. micrantha* are very rare. Of

the *Canina* group *R. surculosa* and *R. senticosa* are well represented. *R. Borreri*, *R. Reuteri*, *R. implexa*, *R. Watsoni*, and *R. dumetorum* occur in various parts of the district. A form, which Dr. Christ named *R. concinna*, occurs as a single bush near Birch Coppice, *R. Bakeri*, near Shilton, but just in the Anker district, and *R. bibracteata*, in Gulley Gap; but the prevailing Rose is *R. arvensis*. *R. spinosissima*, *R. Sabini*, *R. rubiginosa*, and *R. mollissima*, all recorded from the Sence Valley, I have not found in the Anker district. Among the plants of the meadow lands the Ladies' Mantle, *Alchemilla vulgaris*, and the Meadow Barley, *Hordeum pratense*, are both rare; but *Orchis morio*, *Colchicum officinale*, *Bromus racemosus*, *B. commutatus*, *Ophioglossum vulgatum*, and *Botrychium lunaria*, I have not observed. These are all recorded from the Sence Valley.

None of our Warwickshire rivers can surpass the Anker in the abundance of plant inhabitants, and we see on every side the beautiful purple Loose-strife, *Lythrum salicaria*; forest-like growths of the Reed, *Phragmites communis*; the Bulrush, *Scirpus lacustris*; and the Reed Grass, *Glyceria aquatica*; now and again the Arrow Head, *Sagittaria sagittifolia*; the beautiful flowering Rush, *Butomus umbellatus*; and the Water Betony, *Stachys palustris*; the Yellow Cress, *Nasturtium amphibium*; the Horned Pondweed, *Zannichellia palustris*; and streaming masses of the Floating Crowfoot, *Ranunculus fluitans*. But the most noticeable, because most rare, in North Warwick is the Floating Œnanthe, *Œnanthe fluviatilis*; this plant is evidently brought into this river by the small stream which rises near Market Drayton, as it does not occur anywhere in the river until we get a little above where that stream enters the Anker. Here it suddenly becomes abundant and continues at intervals on to Tamworth. In streams near Bole Hall, I find the opposite-leaved Pondweed, *Potamogeton densus*, a plant not before noticed in North Warwick, and near Anker bridge the neglected Bur-reed, *Sparganium neglectum*, and an abundant growth of the Starwort, *Callitriche obtusangula*; in the canals and other waters I also get *Chara fragilis*, *C. Hedwigii*, *Potamogeton mucronulatus*, *P. zosterifolius*, *P. pusillus*, *Typha angustifolia*, and very rarely *T. latifolia*. *Carex pendula* and *C. Pseudo-cyperus*, occur in various parts of the district, but the conspicuous Hemp Agrimony, *Eupatorium cannabinum*, is, so far as I have observed, absent from the district.

The foregoing will give some slight idea of the peculiarities noticeable in the flora of this district.

(*To be continued.*)

THE MIDDLE LIAS OF NORTHAMPTONSHIRE.

BY BEEBY THOMPSON, F.G.S., F.C.S.

PART I.

(Continued from page 43.)

During the boring for water at Gayton, some three years ago, several of the Middle Lias beds were passed through, indeed all that are developed in this neighbourhood. For the section given below I am indebted to Mr. H. J. Eunson, F.G.S.

Section at Gayton Boring.

	Feet	In.
1.—Surface soil	1	0
2.—Alluvial clay	7	0
3.—Shale, with the limestone of *Fish* and *Insect-bed* ...	0	4
4. B.—Limestone rock, with *Rhynchonella tetrahedra*...	2	8
5.—Clay	2	8
6.—Limestone rock, with *Protocardium truncatum* ...	4	4
7.—Clay, containing *Gresslya seebachii*	7	0
8. L.—Rock. A hard mottled stone, in which a good quantity of water was obtained. The boring actually commenced in this bed	2	3
9.—Blue sandy clay, very micaceous, with *Ammonites margaritatus*	6	6
10.—Rock	0	9
11.—Clay	2	0

The boring was continued to a total depth of 994 feet, but through beds with which we are not here concerned.

I have only personally examined beds 8 and 9 from the above section, hence it is perhaps advisable not to attempt to identify the beds 5, 6, and 7, which intervene between B and L. One thing is pretty evident: the Middle Lias beds here are not so fully developed as they are further westward, and this is confirmed by a section at Milton, about two miles east of the locality of Gayton boring. A well was being sunk at the brewery, and the proprietor, Mr. East, very kindly gave Mr. W. D. Crick and myself every facility for examining the beds passed through.

Section of Well at Milton.

	Feet	In.
1.—Soil and clay	3	0
Communis-beds.		
2.—Light blue clay, numerous small *ammonites*, chiefly *A. communis*	6	0

Serpentinus-beds.

3.—Yellowish or red sandy clay, with a few nodules, the representative of Lower Cephalopoda-bed ... ...1ft. to 1 6

4.—Dark blue clay, scarcely any fossils 4 6

Fish and Insect-beds.

5.—Paper-shale, 6in.
Fish-bed ... 6in.
Paper-shale, 6in.
} Fish remains abundant in all these beds 1 6

Transition-bed.

A. 6.—This bed only indifferently represented, and where present it is hard and the fossils poor. *Ammonites acutus.* ... ...

Rock-bed.

B. 7.—Hard stone, very black in fissures, blue hearted, *pebbles* and *concretions* rather plentiful. *Pecten dentatus*, *Terebratulæ*, &c. About 2ft.

D. ?. { Very ferruginous bed, highly fossiliferous, fossils obtained best from top. *Modiola*, &c. About 1ft.
Light coloured and soft rock, quite oolitic in places, containing :—*Cardium truncatum*, *Pecten liasinus*, *Pholadomya*, *&c.* About 1ft. }

} 4 0

I. 8.—Dark blue micaceous clay, getting more sandy
J. towards the bottom ... ...
K. A band of highly-fossiliferous nodules about 1ft. from top, containing:—*A. margaritatus.* Other fossils, chiefly from clay :—*Ostrea sportella*, *Ostrea cymbium*, *Pecten æquivalvis*, *Plicatula spinosa*, *Avicula inæqualvis*, *Cardinia antiqua*, *Pleuromya costata* ... ...

} 10 0

L. 9.—Hard bed, seems to be made up of highly-fossiliferous nodules. This bed yielded a good supply of water under pressure, and so was only just broken into. From the single nodule obtained, the following fossils were extracted :—*Turbo cyclostoma*, *Pecten æquivalvis*, *Pecten liasinus* (very large), *Limea acuticosta*, *Plicatula spinosa*, *Avicula inæquivalvis*, *Cardinia lævis*, *Cardinia antiqua*, *Protocardium truncatum*.

The matrix resembles that of Bed "L" at Gayton and elsewhere.

The Upper-beds have a dip of ten degrees W.S.W. Here again I have only been able to identify with certainty "A," "B," and "L," though I have little doubt that 8 is the representative of "I," "J," "K," and that 7 includes more than the Rock-bed. I think it was the presence of Terebratula (punctata?) in the lower part that induced me to put the fossils obtained from there under "D."

Two other sections may be found between Milton and Northampton, one to the right and the other to the left of the road. The one nearest Milton—right hand side going towards Northampton—is almost obscured now, though the Rock-bed itself may be seen around the field under the hedge. The *Paper shales* and *Fish and Insect limestone* are not quite so well developed here as in the village, but the Lower Cephalopoda-bed and Transition-bed much better. The latter has yielded:—*Ammonites acutus*, *Ammonites Holandrei*, *Ammonites communis*, *Eucyclus concinnus*, *Cucullæa Münsteri*, *Lima punctata*, *Astarte voltzi*, *Rhynchonella tetrahedra*, *Waldheimia resupinata*, *&c.*

Several things from here require identification, and one or two may be new.

In a field a little way from the road, on the left-hand side, and not far from the section just referred to, the Rock-bed may be seen, with traces of the Transition and Fish-bed at the top. The stone is mostly of a rubbly character, and used for road mending. The Rock-bed at this place presents only its normal characters; there is nothing like the three-fold division of bed No. 7 in the Milton section, although less than a mile away.

The only other section I now have to refer to is one at NORTHAMPTON. In a boring for water made on the Kettering Road some few years ago, the whole of the Upper, Middle, and Lower Lias was passed through, and the following is the sequence of beds from near the bottom of the Upper Lias to about the top of the Lower Lias. It is the account given by the miners who sank the first shaft, before the boring actually commenced, and was given to me by Mr. H. J. Eunson, F.G.S.:—

SECTION AT THE KETTERING ROAD WELL AND BORE HOLE.

	Feet	In.
1.—Surface clay and marl	4	0
2.—Blue clay	147	0
3.—Green rock (fossils)	4	0
4.—Binds* (fossils)	1	0

* Binds. A miner's term for tough shales or clays, but not very precise in its meaning.

	Feet	In.
5.—Green rock	6	0
6.—Rock binds	2	0
7.—Hard green rock (fossils)	7	6
8.—Strong rock binds (fossils)	2	6
9.—Hard binds	3	6
10.—Binds (fossils)	8	0
11.—Hard grey rock	2	6
12.—Rock binds	3	6
13.—Light coloured rock	1	6
Clay, with bands of ironstone, cement stones, shell bands, &c. Twenty-three hard beds ...	545	0
Bottom of Lower Lias clay	738	0

Of course from the above description it would be impossible to identify the various beds except by analogy in the sequence, and using this method, I should consider the various beds to be as follows:—(3) Cephalopoda-bed, (5) Lower Cephalopoda-bed or Fish-bed, (7) Rock-bed B, (11) Bed L. Comparing beds 7 to 11 in the above section with beds 4 to 8 in the Gayton one, a remarkable resemblance will be noticed in the thickness. If I have correctly indicated the beds 3 and 5, I cannot help thinking that their thicknesses are greatly exaggerated, and the intervening clay beds proportionately decreased. My chief reason for accepting the sequence of beds and doubting the figures, rests on the fact that, by permission of Mr. J. Eunson, C.E., F.G.S., I myself measured what I considered to be the same beds within a mile of the Kettering Road section, at the old Water-works well on the Billing Road, Northampton, and I found the beds to be as follows:—

	Feet	In.
1.—Hard bed, containing very many *ammonites*, large *nautili*, *&c*.	0	9
2.—Clay, containing *A. communis*, &c....	2	6
3.—Limestone, splits into slabs, with *A. communis*, *&c*. Did not certainly identify as Fish-bed ...	5 or 6in.	
4.—Clay	2	8
5.—Marlstone Rock-bed...		

With regard to the character of the Middle Lias eastward of Northampton we know at present very little. There is distinct evidence of the occurrence of the Rock-bed seventeen miles to the N.E. of Northampton, and equally clear evidence of the total absence of the Middle Lias near to Peterborough.

(To be continued.)

THE MONUMENTAL BRASSES OF WARWICKSHIRE.

BY E. W. BADGER, M.A.

(*Continued from page 53.*)

BAGINTON.—*Sir Wm. Bagot*, 1407, *with arms on jupon, and wf. Margt.* (*Whatton*), *in mantle* (*head restored*), *both with SS. collars, large. Haines.*

These fine effigies, which have been relaid and re-enamelled, and are now fixed upon the south wall of the chancel, are nearly 4ft. 10in. long. The knight, who is clad in mixed armour of mail and plate, wears upon his head a sharp-pointed helmet called a *bascinet*, the border of which is chased with a scroll-pattern. The sides of the head and neck are defended by the *camail* of chain mail, which was fastened by laces to the helmet, and had an opening for the face. Round the knight's neck is the collar of SS., of which little is known beyond the fact that it is a badge of the house of Lancaster, first granted by Henry IV. The body-armour is a *habergeon*, or short hauberk of chain-mail, the edge of which is seen below the *jupon*, which is a short, sleeveless garment fitting close to the body, escalloped at the lower edge, and made of velvet or silk. In the present instance the jupon is embroidered with the arms of Bagot: arg. a chev., gu., between three martlets sa.; a crescent for difference. The shoulders are covered with *epaulières* of five or six plates; the upper arms with *brassarts*, which are fastened by two straps; the elbows with *coutes*, and the forearms with *vambraces*. Upon his hands, which are upraised, the knight has gauntlets, the knuckles of which are armed with pointed projections called *gadlings*, used sometimes for offence. The thighs, knees, and legs of the effigy are encased respectively in plate armour, called *cuisses*, *genouillières* with plates below them, and *jambs* (which are fastened with straps). Gussets of mail are seen at the knees and insteps. Upon his feet, which rest upon a lion, the knight has pointed *sollerets* and rowelled spurs. An ornamental transverse belt surrounds his hips, and supports at his left side his sword, with its straight cross-guard, and at his right an *anelace*, *misericorde*, or dagger. The scabbards and hilts of these weapons are richly engraved.

At the knight's right side is his wife. Her head rests upon two cushions, the lower of which is plain, the upper being richly ornamented and tasselled, and set diamond-wise. The lady's hair is dressed in two large plaits which are kept in place, one on each side the face, by a narrow ornamented band, presumably of metal. Round her neck is a collar of SS. Her fur-lined mantle with its *fermailes*, the sideless dress and kirtle, are very similar to those of the lady at Astley (see above). In the present example, however, there is an ornamented belt encircling the kirtle. At the lady's feet are two lap-dogs with collars of bells.

An engraving of the brass with a mutilated inscription, and shields bearing the arms of the knight and lady, is given by Dugdale, who states that Sir Wm. Bagot was a knight of the shire in several of Richard II.'s Parliaments. At Bolingbroke's rebellion he remained faithful to Richard, with whom he was a favourite, and in consequence was imprisoned by the usurper, who, however, eventually set him at liberty and restored his lands, and, it would seem, decorated him with the collar of SS. It is said that Henry Bolingbroke slept at the castle of the Bagots at Baginton the night before his meeting with Thomas Mowbray, Duke of Norfolk, in the lists at Coventry. Readers of Shakespeare's "Richard II." will remember that Bagot is one of the characters in the play, and that the interrupted duel forms one of the chief scenes.

BARTON.—*Edm. Bury*, 1558, *and wife Elizabeth (Underhill)* . . . 1608, (*eff. lost*) *and* 3 *children. Haines.*

This brass has been sadly interfered with. The effigy of the lady is lost, and the plates which are left have been relaid in a new stone, without any regard to ordinary usage.

The remaining effigy is 1ft. 10in. high, and represents a civilian with closely cropped hair, moustache, and pointed beard. Round his neck is a ruff, and he wears a gown open in front and reaching to the feet. The sleeves of the gown reach nearly to the knees, but are mere strips depending from the shoulders. Beneath the gown is a short doublet buttoned to the chin and belted; its sleeves are moderately tight and have no cuffs. Trunk-hose, hose, and low shoes complete the costume. The figure is well drawn and in good preservation.

Opposite the effigy is a shield, 6½in. long, bearing the arms of Bury: Arg., on a chev., sa., three squirrels cracking nuts, ppr. [Kittermaster, Warw. Arms and Lineages, p. 16, puts the chev. between the squirrels]. Below this, to the left, is a plate 7½in. sq., engraved with the figures of two

boys and a girl, the former dressed like the father; the latter has her hair brushed back under a Paris hood, and wears a ruff, and a dress with pointed stomacher, tight sleeves puffed at the shoulders, and a plain skirt projecting from the hips.

Beneath these plates is another, 2ft. 2in. by 1ft. 2in., bearing this inscription in Roman capitals:—

Vnder this stone are bvried the bodies of Edmvnd Bvry and | Elizabeth his wife which Eliz: was the 7 davghter of Ed | ward Vnderhill of Neather Etington in the covntie of | Warwick Esq: the saide Edmvnd deceased the 22 of Janvary | 1558. bvt the saide Eliz: svrvivinge the saide Edm: tooke to | hir seconde hvsband Thomas Tawyer of Ravndis in the cov̄ | tie of Northamp: gent. whom she also overlived & then re | tvrninge into Warwicks: hir native covntrie & desiringe af | ter this life endid to have hir body laide in the chan | cell of the p̄ish chvrch of Barton on the Heath in the covn | tie of Warw: aforesaide wth the body of the saide Emvnd (*sic*) hir | first hvsband cavsed this stone to be prepared Ano Dn̄i | 1608 for a memorial of the saide Elizabeth. William. | John. Margaret. | when Christ which is ovr life shall appeare then shall we also appeare wth Him in glory. Coll. 3. 4 |

William, John, and Margaret are the names of the three children represented above. As the brass was put down fifty years later than Edmund Bury's death, we may fairly presume that the costume represented is not *quite* that worn in 1558. (Compare Compton Verney, III.) To the right of the inscription is a shield 6½in. long, bearing the arms of Underhill: Arg., a chev., sa., between three trefoils slipped, vert.

In the fourth line the engraver by mistake put Edward for Edmund, and has imperfectly corrected his error. There seems also to have been an erasure after the name Margaret. Dugdale in quoting this inscription gives "Sawyer" for Tawyer, and inserts "Edmund" in the fourth line from the end.

CHADSHUNT. I.—*William Askell, civilian,* 1613. *Mural. Nave.*

This brass is not mentioned by Haines. It consists of two plates set in a mural tablet 1ft. 9in. square, with a moulded border, and is over a pew on the south side of the

nave. The upper plate is 1ft. 4in. by 5in., and bears this inscription :—

HERE LYETH THE BODY OF WILLIAM
ASKELL OF GEYDON GENT: WHO DE-
CEASED THE VI OF FEBRVARIE ANNO
DN̂I 1613. ÆTATIS SVÆ XLVIII.

Beneath this is a plate about 1ft. by 11½in., having its upper corners moulded off. Upon it is engraved the figure of a civilian, very similar to that at Barton described above. In the present instance the hair is longer, the sleeves of the gown a little shorter, and those of the doublet have cuffs. William Askell is kneeling on a tiled floor, his knees resting upon a tasselled cushion. Before him is a prayer desk or small table covered with a fringed cloth, upon which rests a book-desk bearing an open book. The present writer is indebted to the Rev. C. Francis, Rector of Tysoe, for information of the existence of this brass, a further account of which will be found in the "Midland Antiquary" of April, 1885.

II.—On the north side of the aisle, upon the floor, is a plate of brass, 1ft. 7½in. by 4½in., bearing this inscription :—

HEARE LYETH BVRYED THE BODY OF
THEOPHILVS WILKINS LATE OF GEADON
WHO DIED ON THE FIRST DAY OF AVGVST. 1613.

CHARLECOTE.—There were two brasses in this church, one in memory of John Marskre, chaplain, circ. 1500, the other to Edm. Wykham, gent., of the same date. I am informed by the Vicar of Charlecote that both these memorials disappeared at the rebuilding of the church in 1851, and that a search for them was unrewarded.

COLESHILL. I.—*Wm. Abell, Vicar*, 1500, *with chalice, small, chancel. Haines.*

This effigy is 13in. long ; the plate bearing the inscr. is about 13in. × 3in. Wm. Abell is tonsured and clad in some of the Eucharistic vestments. These are :—(1) The *Amice*, an oblong piece of linen having an ornamental lappet, called an *apparel*, sewn on one of its long edges. It was worn round the neck and fastened by strings crossed upon the chest, and resembled a deep embroidered collar. (2) The *Chasuble*, an oval vestment with an aperture in the centre through which the head passed, the vestment falling over the shoulders before and behind. In the present instance the chasuble is plain, but it was not unfrequently ornamented back and front with a

Y-shaped orphrey. It was made of various materials and varied in colour with the festival or season of the Christian year. (3) The *Albe*, a white linen vestment like a cassock, but fuller, reaching to the feet, and with close-fitting sleeves. It was girded at the waist and generally ornamented with apparels on the upper side of the cuffs, and at the edge of the skirt in front. In the present instance it is plain. In addition to these vestments the celebrant at mass wore the *stole*, which resembles a long narrow scarf generally embroidered and fringed at the ends, and the *maniple*, which may be described as a miniature stole worn upon the left wrist. The chasuble, stole, and maniple would always be of the same colour. Wm. Abell is without the two last (compare the brass at Whitnash), and Haines considers this a mark of provincial production.

The priest holds a large chalice, over which is a wafer with the letters **ihs**.

The following is the inscription :—

> **Hic jacet dn̄s willm' abell quōdm vicari' isti' ecclie qui quidē dn̄s willm' obiit xviii° die mēs maye. āno dn̄i m d cui' aīe ppiciet' de' amē.**

Translation :—

Here lieth Sir William Abell formerly vicar of this church, which Sir William died the 18th day of the month of May, A.D. 1500 ; whose soul God pardon. Amen.

In inscriptions clergy who were non-graduates are called *dominus* ; graduates are called *magister* (see Fuller, Church Hist., vi., 5, 10). This distinction will in future papers be suggested by translating *dominus* 'sir,' and *magister* 'master.'

There is an engraving of this effigy in the Imperial Dictionary, under the word "brasses."

II.—*Alice, dau. of Simon Digby, and w. of Robt. Clifton. Esq.*, 1506, *C. Haines.*

This figure is about 2ft. long, and is considered by Haines to be the work of a provincial artist. The lady wears the kennel-shaped head-dress, with long lappets ; her dress is high in the neck, and has sleeves reaching to the knuckles. Round the waist is a loose belt, terminating in two rosette-like ornaments, probably of metal. From the belt depends a chain, to which is fastened a highly ornamental pendant of open metal-work, representing either a *pomander* to hold scent or preservatives against infection, or a receptacle for a heated metal ball for warming the hands. Dugdale gives an illustration of this brass, and supplies the following imperfect

inscription, which still runs round the edge of the tomb:— "Of your charitie pray for the soule of | Alice Clifton late the wyffe of Robert Clifton, Esq. and daughter of Simon Digby Esq., wh: Alice | . . . | and the year of our Lord God MCCCCCVI. on whose soules Jhu have mercy. Amen."

From Dugdale we learn that Simon Digby, the father of Alice Clifton, first supported the House of York in the Wars of the Roses, and received considerable benefits in consequence. He afterwards "fought stoutly" for the House of Lancaster at Bosworth, and reaped a rich reward. He was Constable of the Tower in the reign of Henry VII., and acquired the Manor of Coleshill in that king's reign, after the execution of Sir Baldwyn Mountfort, the previous holder, who assisted Perkin Warbeck.

III.—*Sir John Fenton, L.B., Vicar, Official of Coventry,* 1566. *C. Haines.*

The influence of the Reformation will be noticed in the altered dress of this cleric, who is vested in a long Genevan preaching-gown with high collar and wide sleeves, beneath which the collar and cuffs of his cassock are visible. The priest wears long hair, and is not tonsured. He points with his right forefinger to a closed book inscribed with the words **verbū dei,** which he holds in his left hand.

At his feet is a plate 1ft. 5in. by 4½in. bearing this inscription:—

> **Here lieth the body of Syr John Fenton prest**
> **Bachelar of law sumtyme vicar of this church and**
> **Offishall of Coventree. Who deceassed the xvii daye**
> **of Maye 1566. Whose soule Jesus pardon. Amen**

The title "Syr" should be noticed as an exception to Fuller's rule quoted above. The post-Reformation prayer for the dead will also be noticed.

In Latham's Dictionary this passage is quoted: "*Official* is that person to whom the cognizance of causes is committed by such as have ecclesiastical jurisdiction.—*Ayliffe, Parergon Juris Canonici.*"

The three brasses described above have been restored by Messrs. Waller.

IV.—*Inscription. Mary Milward,* 1651. C.

This inscription is not recorded by Haines. It is in very refined Gothic characters, and is engraved on strips of brass 4½in. wide set round a large flat stone.

Here lyeth the body of Mary Milward late wife to John Milward of Bradlnash in the county of Darby Esqr. who lived at Colshill Hall with the Right Honble the Lady Offaly of whom she was much regarded and died there Aug. 17. 1651.

V.—*Arms and Inscription. Richd. Beresford*, 1651. N.

Two plates, the upper one 1ft. 2in. by 11½in., bears the arms and crest of Beresford.

The lower plate, 1ft. 11in. by 10in., bears this inscr.:—

Here lyeth interred the body of Richard Beresford gent. who tooke to wife Alice the davghter of Thomas Wilington gent. They were married 19 yeares, and had issve 4 sonnes and 4 davghters. He departed this life the 4th of September 1651. Aged 37 yeares.

(*To be continued.*)

Review.

British Zoophytes: An Introduction to the Hydroida, Actinozoa, and Polyzoa found in Great Britain, Ireland, and the Channel Islands. By Arthur S. Pennington, F.L.S., F.R.M.S. London: L. Reeve and Co.

In this book Mr. Pennington has produced a work intermediate between the monographs of such specialists as Hincks or the Hertwigs and the popular writings of the Rev. P. H. Gosse. On the other hand, whilst preserving the scientific accuracy of the former authors, and giving in a condensed form the latest and best results of modern research, he has also been able to invest technical details with some of the fascination of the latter. The book commences with a very interesting history of the investigations that have been made into the subject, from those of Ferranto Imperato in the year 1599, down to Dr. André's recent work, and then follows the general classification and distribution of species. Here it is gratifying to find that it is not external characteristics merely which have been described, but that the requirements of modern zoological science have been met by a good account of the typical internal anatomy, and even histology, of each of the three groups mentioned in the title. The classification followed is that of the well-known naturalist, the Rev. Thomas Hincks, but that of Professor Allman is also added. All known British species are described, and their various synonyms and habitats given; but, in addition, many interesting passages from the works of Gosse, Johnston, Ellis and others enliven what would otherwise be mere enumeration of dry facts. Thus we are told that Dr. Landsborough

sent Dr. Johnston a specimen of *Lytocarpus myriophyllum* which "was got by a fisherman, adhering to his long lines, off Whiting Bay, Arran, who, being struck with its beauty, like a kindhearted man, took it home as a present to his wife, and she, being a person of similar taste, admired it as much as her husband had done. With all due care, therefore, she planted it in an old teapot filled with earth, and, watering it with fresh water every morning, she had the satisfaction of thinking that it grew a little larger under her judicious management!" The following anecdote, told by the author himself, is so delicious we must extract it. A Filey fisherman, seeing him take a specimen of *Antennularia ramosa* out of the dredge, observed that he "had had one of that kind, which stuck to his lines, growing in a plant pot out of doors, and that it had stood the winter very well!" There are twenty-four plates of illustrations which are of unequal merit. Those diagrammatic of the internal anatomy of the groups are as far as they go, clear and accurate, but many are on so small a scale as to afford but little aid in the identification of the species they represent. A good bibliography of the subject is given, and also a glossary of the technical terms used and indices of the popular and scientific names. The last contains "all the synonyms whose identity with present nomenclature has been established," and is full, and, as far as we have tested, accurate. With the exception mentioned as to some of the illustrations the book is exceedingly good, and well worthy of recommendation. A. B. B.

METEOROLOGICAL NOTES.—January, 1886.

Atmospheric pressure was very unsteady, and its changes both numerous and rapid. The highest point reached by the mercurial column was 30·149 inches, on the 12th, which is much below the maximum usually attained in January. The lowest reading was 28·988 inches, on the 18th. With the exception of the first three days the weather was generally cold, but not severe. Frost and thaw alternated in quick succession. The highest maxima, which occurred on the 1st, 2nd, or 3rd, were 55·0° at Henley-in-Arden, 51·3° at Hodsock, 51·0° at Loughborough, 50·0° at Coston Rectory, and 49·9° at Strelley. The lowest minima were 16·0° at Henley-in-Arden, on the 8th; 16·5° at Hodsock, 18·2° at Coston Rectory, 20·8° at Strelley, and 23·9° at Loughborough, on the 19th. On the grass, 10·9° at Hodsock, on the 25th; 13·5° at Strelley, on the 9th; and 19·6° at Loughborough, on the 7th. In the rays of the sun, 90·9° was recorded at Hodsock, on the 31st; 81·4° at Strelley, on the 2nd; and 79·2 at Loughborough, on the 30th. Snow, or rain, fell on 22 or 23 days, and the totals were generally in excess of the average for the month. The values were—at Henley-in-Arden, 3·50 inches; at Strelley, 3·41 inches; at Hodsock, 3·24 inches; at Loughborough, 2·80 inches; and at Coston Rectory, 2·63 inches. The total fall in the 24 hours did not, in any instance, reach half an inch. The wind freshened to a moderate gale, from S.S.W., on the evening of the 16th. Sunshine was rather above the average.

Wm. Berridge, F. R. Met. Soc.
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Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—On February 2nd the Annual Meeting was held at Mason College. The annual report showed that a small decrease had taken place in the number of members, which is now about 240; but that the work of the year had been carried on by the members in a very satisfactory manner. The treasurer's report showed an adverse balance of about £37, or, including a few outstanding debts, about the same position as at the last report. Mr. R. W. Chase was re-elected president; Professor W. Hillhouse and Mr. W. B. Grove vice-presidents; of the ex-presidents, Messrs. Hughes, Levick, Marshall, and Waller were also elected vice-presidents; Mr. C. Pumphrey, treasurer; Mr. W. B. Grove, librarian; Messrs. G. M. Iliff and H. Miller, curators; Messrs. J. Morley and W. H. Wilkinson, hon. secretaries; Messrs. Bagnall, Browett, France, Goode, Rabone, and Udall were elected as the committee. The meeting was then adjourned to receive the retiring president's address at a future date.— Biological Section.—February 9th. Mr. W. P. Marshall in the chair. Mr. W. P. Marshall was elected president and Mr. J. E. Bagnall secretary of the section for the ensuing session. Mr. W. H. Wilkinson exhibited a moss, *Neckera crispa*, from Italy. Mr. J. E. Bagnall, a series of brambles, from the United States and for Mr. J. B. Stone, J.P., a large collection of plants, from the Pacific Slopes and Vermont, U.S., giving also notes on the physical features of the country, and the geographical distribution of the various species. These represented the natural orders: Ranunculaceæ, Berberidaceæ, Papaveraceæ, and Fumariaceæ.—General Meeting, February 16th. Prof. W. Hillhouse, M.A., in the chair.—The Chairman exhibited the following high power objectives: one-twelfth oil immersion lens, by Leitz, of Wetzlar; one-sixteenth glycerine immersion lens, by Parkes and Son, Birmingham; one-twentieth glycerine immersion lens, by Parkes and Son, Birmingham; illustrating their powers by various test objects. Mr. W. R. Hughes, F.L.S., exhibited on behalf of Mr. F. W. Sharpus, of London, slides of *Platessa flesus*, the common plaice; *Cyclopterus lumpus*, the lump sucker; *Pycnogonum littorale*, *Palinurus quadricornis*, *Hyas araneus*, and Odontophore of *Littorina littorea*. These specimens were all mounted in Canada balsam, the delicate staining of the two first showing the internal structure most exquisitely. Mr. Hughes pointed out that *Platessa* and *Cyclopterus* among the fishes, and *Palinurus* among the crustacea, exhibit most interesting phases of embryological development. Mr. T. Bolton exhibited *Floscularia calva*, a new floscule discovered the year before last at Dundee, and now found by Mr. Bolton, near Kingswood. Mr. T. Bolton then read his paper on the "Enumeration of specimens of organic life, both animal and vegetable, found in a swampy ditch in Sutton Park." The list included a number of species never found before in Great Britain. The paper will be printed in the "Midland Naturalist."—Sociological Section. Thursday evening, W. H. France read the XI. Chapter of Mr. Herbert Spencer's "Study of Sociology" on "The Political Bias." Mr. W. R. Hughes, F.L.S., President of the Section, Mr. F. I. Cullis, Mr. A. Browett, Hon. Sec., and others taking part in the discussion which ensued.

BIRMINGHAM MICROSCOPISTS' AND NATURALISTS' UNION.—January 18th. Mr. J. Madison exhibited a small collection of marine shells; Mr. Tylar, a series of photographic negatives of microscopic objects; Mr. Hawkes the following fungi:—*Polyporus versicolor*, *Nectria coccinea*, *Stereum purpureum*, and *Nectria cinnabarina*. Under the microscope, Mr. Hawkes exhibited some preparations of the latter fungus, and described, with the aid of highly magnified drawings of the conidia and sporidia, its two modes of fruiting, one of which was formerly believed to be a different fungus and was known as *Tubercularia vulgaris*. Mr. Rodgers read a paper on "The Star Sirius," in which he described its enormous magnitude when compared with our sun, and that it usually gave a white light, though frequently appearing coloured. The ideas of the ancients respecting it were considered, and the frequency of its mention in their myths. Modern researches show that Sirius is not the nearest star, as was at one time thought. The writer also described the annual displacement of this star, its spectrum, its motion through space, circling around another orb, the search for and supposed finding of this orb, shining with a faint light, and concluded by saying that Sirius, from its size and rank, well merited the title of the "Giant Sun."—January 25th. A lime-light exhibition was given by Mr. C. Pumphrey, of a large number of photographic views of Canadian and American scenery taken by himself during a recent visit to those countries. The views were of a varied kind, and comprised many of a most interesting character of the Yellowstone Park, with its hot springs and geysers and the peculiar rocky deposits formed by them, and also of the Yellowstone River, that showed the same rocks in section. At the conclusion a hearty vote of thanks was accorded to Mr. Pumphrey for his kindness.—February 1st. Mr. Hawkes exhibited a geometric slide for the magic lantern, and explained the principle by which various designs could be drawn, also a lichen, *Cenomyces deformis*; Mr. Dunn, a number of insects from Calcutta. Under the microscope, Mr. Hawkes showed a series of slides of sections of buds from various trees, some through the immature flowers, and drawings and specimens illustrating the same. Mr. P. T. Deakin read a paper on "Oology as a study," describing the period of the nidification of birds as a most interesting one. A collection of eggs should not be large, two of each species being amply sufficient, with a few varieties. Several classes of birds were referred to where the eggs bore a strong family likeness, but local differences were sometimes found difficult to account for. The paper dealt with the colour of eggs and gave reasons for them, and concluded by referring to the ancient ancestry of birds, their embryology, and some ways in which evolution had favoured them. A collection of eggs was exhibited.—February 8th. The President, Mr. C. Beale, C.E., delivered a lecture on "What is around us." The extensive view from the summit of Sedgley Beacon was described, and the fossils of its lower beds passed in brief review. The surface layers resting on the topmost members of the Silurian caused us to ask "Where is the carboniferous limestone?" The absent beds were described at some length, as being of enormous extent, amounting in all to 19,000 feet between our local development of the Silurian and Carboniferous systems. The fossils of each were referred to as indexes of climate and the upward march of organisms. The true coal was mostly laid down in fresh water. The vast accumulation of vegetable matter composing our 10 yard seam was computed to have taken not less than 250,000 years. The lecturer concluded by describing the intrusive rocks of the district, and how the everlasting see-saw of land and water had left, and was still

leaving, its marks upon the earth.—February 15th. Mr. Hawkes exhibited, under the microscope, Gemmæ and Protonema of moss, *Aulacomnion androgynum.* Mr. J. W. Neville, section of cement-stein from Isle of Fur, Denmark, showing *Trinacria excavata* and other diatoms in *situ.* Mr. Tylar, gemmules of *Spongilla fluviatilis.*

LEICESTER LITERARY AND PHILOSOPHICAL SOCIETY. Section D, Zoology and Botany. Chairman, F. T. Mott, F.R.G.S. Monthly Meeting, Wednesday, February 17th. Attendance twelve (three ladies.) The following objects were exhibited, viz.:—By Miss Shenton, coloured drawings of Leicestershire fungi, *Morchella, Clavaria, Geoglossum*, &c., very delicately executed; and a collection of dried plants from the Black Forest. By Mr. W. A. Vice, fresh specimens of Leicestershire fungi, *Daedalea, Sphæria*, &c. By Mr. F. Bates, the first number of the new work by Dr. Hudson, on "The Rotifera," with coloured plates, to be completed in six numbers, at 10s. 6d. each. Mr. E. F. Cooper, F.L.S., called attention to a recent article in the *Daily News*, referring to the possibility of driving out an injurious Bacterium from the human body by the introduction of an innocuous and more vigorous one. Dr. Tomkins said in reply that there was not at present sufficient evidence of the truth of the statements contained in the *Daily News.* Several microscopes were set up fitted with cameras of different forms, and experiments were made in microscopic drawing. Dr. Tomkins remarked that photography was now superseding hand-drawing of microscopic objects. Photographic apparatus for the purpose could be bought for about 30s., exclusive of developing apparatus.

PETERBOROUGH NATURAL HISTORY, SCIENTIFIC, AND ARCHÆOLOGICAL SOCIETY.—January 22nd. Geological Section.—Chairman, Mr. E. Wheeler. Six members present.—Chap. VII. of Lyell's "Student's Elements" was read and considered. The Chairman read a portion of Darwin's theory of Atoll formations from the "Voyage of the Beagle"—the remaining part to be read at the next meeting.—January 29th. Botanical Section.—Chairman, Mr. J. W. Bodger. Nine persons present.—The Chairman gave an address on "The Root or descending axis of Plants," dividing it into true or primary and adventitious or secondary, explaining and illustrating the terms pileorhiza, coleorhiza, exorhizal, endorhizal, and heterohizal; the mode of growth of the chief kinds of roots, giving illustrations of fibrous, coralline, tuberculated, palmate, fasciculated, nodulose, annular, moniliform; and the modifications of taproots, as conical, fusiform, napiform, placentiform, contorted, and premorse.—February 5th. Geological Section.—Chairman, Mr. E. Wheeler. Six persons present. —The Chairman concluded a reading from Darwin's "Voyage of the Beagle," relating to the formation of coral islands.—February 12th. Botanical Section.—Chairman, Mr. J. W. Bodger. Nine persons present.—The Chairman gave an address on "The Stem or ascending axis of Plants," explaining and illustrating the structure of exogenous, endogenous, and acrogenous stems, the terms nodes, internodes, cicatrix, &c.; adventitious shoots, exhibiting ferns with young plants growing upon older fronds, as examples of the latter; also bulbils in the axils of the leaves of a begonia, and in the inflorescence of *Allium vineale*, and various forms of stems, together with species of Labiates with decussate leaves and quadrangular stems.

NOTES ON THE ANKER VALLEY AND ITS FLORA.

BY JAMES E. BAGNALL, A.L.S.

(Concluded from page 73.)

In the Anker Valley proper there are 661 flowering plants and twenty-two ferns and fern allies. In the Sence Valley, which forms part of the catchment basin of the Anker, Mr. F. T. Mott records 650 species, of which 120 have not at present been recorded from the Anker Valley proper, so that the total flora of the Anker basin will be 803 flowering plants, ferns, and fern allies.

Classes of Citizenship.—These have been very ably defined by Mr. Hewett C. Watson in the "Compendium of the Cybele Britannica." *Native.* "Apparently an aboriginal British species, there being little or no reason for supposing it to have been first introduced into this island by human agency," as examples, *Corylus*, *Calluna*, *Bellis*, *Butomus*. *Denizen.* "Apparently wild, but liable to suspicion of having been introduced by human agency, whether by design or by accident," as examples, *Chelidonium*, *Vinca*, *Ægopodium*. *Colonist.* "A weed of cultivated land, or by roadsides, and seldom found except where cultivation exists," as *Ranunculus arvensis*, *Anthemis Cotula*, *Alopecurus agrestis*. *Alien* species are those certainly or very probably of foreign origin, as *Acer Pseudo-platanus*, *Sedum reflexum*, *Populus nigra*. *Casual* species are chance stragglers from cultivation, such as are found on waste heaps, railway embankments, and sometimes in cultivated fields, as *Trifolium hybridum*, *Medicago sativa*, *Melilotus arvensis*.

The 803 plants are divided as follows :—

Natives	724
Denizens	37
Colonists	25
Aliens or Casuals	17
	803

Types of Distribution.—In making out the types of distribution of the plants found in the Anker Valley, I have again had recourse to Mr. Watson's able work, in which he gives six leading types of distribution, which may be briefly shown thus :—

1. British type.—Species widely spread through S. M. N. Britain.
2. English type.—Species chiefly seen in S. or S.M. Britain.
3. Scottish type.—Species chiefly seen in N. or N.M. Britain.

Intermediate type.—Species chiefly seen in Mid Britain.

4. Highland type.—Species chiefly seen about mountains.
5. Germanic type.—Species chiefly seen in East Britain.
6. Atlantic type.—Species chiefly seen in West Britain.

Of these only four of the types are represented in the district, and as it will better illustrate the nature of the Anker flora, I shall give both the flora of that valley and that of the 120 Sence Valley plants separately. They will be as follows :—

	British.	English.	Scottish.	Intermediate.	Germanic.	Total.
Anker..	423	165	4	1	4	597
Sence..	50	53	1	0	2	106
	473	218	5	1	6	703

The remaining 100 are either varieties, aliens, or casuals not classified by Watson.

It may be interesting to compare the flora of the Anker with that of another Warwickshire River, the Blythe, and with that of Britain as a whole.

The Blythe, which rises near Earlswood, on the Worcestershire side of the county, is for a considerable part of its course an insignificant stream, and its course from its source to its confluence with the Tame, near Hams Hall, is about twenty-three miles. The district drained by it is strictly agricultural. The woods are usually small but fairly abundant, and the district as a whole is flat, but having many minor streams is well watered. The prevailing rocks are those of the New Red Sandstone. In this district I find 825 flowering plants and ferns, or about 142 more than in the Warwickshire portion of the Anker basin, and twenty-three more than in that of the Anker basin as a whole.

The following table will show the distribution of native plants throughout Great Britain, and the relative distribution in the valleys of the Anker and Blythe :—

Types.	Britain.	Anker.	Blythe.
British	532	423	510
English	409	165	194
Germanic	127	4	6
Atlantic	70	0	2
Scottish	81	4	9
Highland	120	0	0
Intermediate	37	1	3
Local	49	0	0
	1425	597	724

So that it will be seen that whilst the Blythe basin yields one half the British native flora, that of the Anker only yields a little more than one-third the British flora ; and I find that

there are 180 species occurring in the Blythe basin that have not as yet been given for that of the Anker, and thirty-nine species occurring in the Anker not yet found in the Blythe.

The moss flora of the Anker basin is not so rich as I had anticipated, my total records being 162 species representing forty-four genera. Still there are many noticeable mosses in the district; such for instance as *Scleropodium cæspitosum*, *Tortula latifolia*, and *Leskea polycarpa*, which are usually rare in North Warwickshire, but are abundant in the Anker district, more especially near Shuttington and Mancetter. *Bryum murale* and *Encalypta streptocarpa* occur in solitary stations near Caldecote. *Didymodon flexifolius*, which I had not previously seen in the county, occurs in abundance on a hilly heath near Atherstone, and *D. luridus*, also new as a record for the county, near Weddington and Grendon. *Fontinalis antipyretica* was abundantly in fruit in a most unlikely-looking pool near Weddington Wood. This is usually a local moss with us, and had not before been found in the fruiting condition in Warwickshire. The influence of the smoky atmosphere seems to make itself manifest in the absence or rarity of tree-loving mosses, such as the *Orthotrichums*, so that one has to walk a distance from the coal district before one spots any trees having such tenants; near Wolvey, however, *Orthotrichum affine* and *O. diaphanum* occur in slight quantity; *O. Lyellii*, *Leucodon sciuroides*, *Zygodon viridissimus*, and *Tortula lævipila* very rarely, and in single stations near Wolvey and Anker Bridge. *Dicranum montanum* and *Ulota intermedia*, in Bentley Park; and on marly banks in Bentley Park *Dicranum majus*, in the barren condition. Stone walls and fences are abundant in the district, but in the smoky parts the mosses are poor and depauperised examples, usually blackened tufts of *Grimmia pulvinata*, *Tortula muralis*, *Bryum cæspiticium*, and the ubiquitous *Ceratodon purpureus*. Marsh-loving mosses, such as the *Sphagnums*, *Aulacomnion*, and the *aduncum* group of *Hypnum* are poorly represented. *Sphagnum fimbriatum*, *S. cymbifolium*, *S. auriculatum*, and *S. contortum* are thinly represented in Bentley Park and on Baddesley Common; *S. acutifolium* and *S. squarrosum*, in a pool near Seckington; *Aulacomnion palustre* and *Hypnum aduncum* on Baddesley Common; but *Leucobryum glaucum*, which I expected to find abundantly, is apparently absent from the district. The most noticeable of the mosses from this district, however, is *Eurhynchium Teesdalii*, of which I found a solitary patch on a stone in the little stream that runs through Bentley Park. The most prevalent moss of all the watery situations is *Hypnum cuspidatum*, which seems to prevail everywhere, and would, I believe, grow in Styx itself.

In conclusion I may say that although the district has a less rich flora than I had anticipated, I do not regret having given it so much attention, for if the investigation has given me little I did not before possess, it has afforded me many pleasant rambles and many happy hours.

ERRATUM.—In the "Midland Naturalist" for February, page 57, line 6, for "Austrey" read "Ansley."

ON THE OCCURRENCE OF FOSSILIFEROUS HÆMATITE NODULES IN THE PERMIAN BRECCIAS IN LEICESTERSHIRE,

TOGETHER WITH SOME ACCOUNT OF THEIR ECONOMIC VALUE, &c.

BY W. S. GRESLEY, F.G.S.

(Continued from page 69.)

Whilst preparing this notice, the author had occasion to examine some fire-clay workings in the neighbourhood (at Swadlincote), where the clay beds and overlying strata are well exposed in an open-cast working in the side of a hill. The lower part of the "baring" (the strata overlying the clay beds in an open-hole working of this kind) consists of argillaceous shale of the coal measures (usually of a blue-grey colour at other places where the same clays are worked in the district), of a blotched, variegated, or mottled appearance ; the colour of the blotches and bands being purple and red. Now this shale contains very numerous nodules of red hæmatite of a rather soft and jointy nature ; round, oblong, disc, and kidney-shaped ; and they peel off very much on the outside. On removing several of these nodules from their beds, I observed that the red stains on the surrounding shale lay very much more closely together than further away from the nodules, and that a regular banded or series of concentric zones or contours of red lines were often seen to run round or exist in proximity to the hæmatite. These nodules are chiefly septarian in structure, are thus nearly solid, and often furnish compact steel-like ore, displaying parallel zones of concretionary structure. Some of them exhibit many varieties of stages between clay ironstone, limonite, and red hæmatite, in layers around a central nucleus. Fibrous ore is sometimes seen lining small cavities in the nodules, and as

we should expect, "box-stone," "eyed" and other concretionary forms are present. The red beds above this shale undoubtedly furnished the colouring matter in the latter, and has so far affected the nodules of ironstones in it as to change them into a kind of hæmatite. I maintain that the process of variegating the shale and forming this hæmatite affords us an interesting case of pseudomorphism or replacement which has taken place *in situ*, in the very manner I think that they must have done in the Permian breccias (though the conditions then were different) and in the very neighbourhood of the hæmatites; in fact, specimens of this Permian ore occur in the breccia of this Swadlincote section.

VERTICAL SECTION OF ROCKS AT SWADLINCOTE, NEAR BURTON-ON-TRENT.

		Feet	In
	Surface soil and clay	3	0
	Sand, sandstone, and pebbles	2	6
Permian.	Light yellow sandstone	2	3
	Breccia—in two beds—containing fragments of hæmatite, &c.	4	0
	Red marl	4	0
	Yellow sandstone	3	0
Coal measures.	Mottled marl or "bind" crowded with nodules and thin bands of red hæmatite (often septarian)	8	0
	Dark "bind" with nodules of hæmatite towards top	7	0
	Coal	1	0
	Fire-clay, called "marl"	3	6
	Do. best quality	4	6
	"Bottle" clay (fire-clay)	7	0
	Coal	2	0
	Fire-clay	2	6
	About ...	54	3

The Permian series rest unconformably upon the Coal-measures.

I have obtained fossils (*Terebratulæ*, *Natica*, *Orthis*, &c.) in the red nodules above referred to, but I have not found any of these Swadlincote nodules to possess polarity; but that the clay-band ironstones of the coal measures do sometimes display this property is certain, from the fact that the author in 1874 picked from a large heap of "stone" on one of the pit-heaps at Hanley, Staffordshire, called the "New Mine" ironstone, a specimen, containing a beautiful bit of a *lepidodendron*,

which he subsequently found to possess poles, sufficiently strongly magnetic to cause the specimen to point north and south when freely suspended and clear of attraction by iron.

In attempting to account for the extreme hardness and compactness of the ore, it would appear that the original carbonates were capable of combining with or taking up a very large quantity of ferric oxide without any increase in size, that this chemical change was accompanied by a re-arrangement of the particles, and I may suggest that possibly electricity had something to do with it, though I am very sceptical on this point. It seems difficult to resist the conclusion, that in the case of the hæmatite nodules of nearly chemical purity, the carbonates from which they have been derived must have been themselves of great purity. The coarser stones,—those presenting a gritty, flinty, and porphyritic appearance—I look upon as probably the only remaining fragments, other than the hæmatite, of the denuded coal measures contributing to form the breccias. The rest of the strata—the coals, clays, shales, and softer beds,—only exist in the Permians in the shape of coarse gravelly sediment, mud, and perhaps a few broken lumps which may have escaped destruction.

It may be said by some that if the pseudomorphic process in clay-ironstones can be proved to have taken place *in situ* in the coal-measures, as in the above-mentioned instance, why may not these hæmatite nodules have been formed in those rocks long before they became turned out and re-deposited in the Permians? My answer is that we know of no rocks from which the iron could produce the pseudomorphic action in the underlying coal measures ever having been formed in the upper coal series, or before the Permian period set in. I believe our British coal-beds, where found of a red colour (known as "red rocks"), are held to have become this colour by iron-staining from newer rocks.* This reddening or blotching is due no doubt to the oxidation of the iron in the rocks, and the colouring is naturally most intense in rocks like clay-ironstone, which contain a large amount of iron.

It is evident that the above-described features and properties possessed by the hæmatite nodules are facts which harmonise singularly well with the theory of pseudomorphism, while they are much less reconcilable with that of sublimation or the cave or fissure-formed deposits. This conclusion, namely, that the ore is of Permian age, is supported by the fact that many of the largest and richest

* The instance of the Froghall hæmatite deposits in the lower coal-series is of course an exception.

deposits of hæmatite in the British Isles have been shown by geologists in all probability to belong to that age:—for instance, the Cumberland and North Lancashire ores, deposits at Llantrissant, &c., in Glamorganshire, &c. With regard to the determination of the locality whence the hæmatite was derived, I believe it is generally supposed that the boulders, &c., in the Permian rocks of the district in question came from the west.

It is right to mention that specimens of hard, compact hæmatite are now and then to be met with along with the nodules from the breccia, which have all the appearance of veinstone, such as might very well be derived from the Carboniferous or Mountain Limestone—the commonest home of hæmatite. But specimens of this or of any other limestone in the breccia are conspicuous by their absence, and I myself am not inclined to think that veinstone ore really exists in this formation. I look upon such specimens as merely angular fragments of compact sedimentary nodules, whose smooth rounded outline does not appear in the fragments, as they are broken out of the interior of them.

Having endeavoured to show why I consider the pseudomorphic theory to be the correct reading of these stones,* I pass on to notice very briefly

5.—The uses in the arts and manufactures to which the hæmatite is put; its value; and how obtained.

As burnishers (bloodstone burnishers) these particular stones are principally if not solely employed. Those that are of any real value are the fragments and nodules the most compact, the toughest, and those of a bluish tint. The very best burnishers are made from the "red-barked" specimens (see Figs. 2 and 6, plate I.), or those coated with a thin layer of bright red powdery ore (anhydrous sesqui-oxide of iron). To prepare them for use they are cut and roughly polished up into a variety of shapes according to the purpose for which they are wanted, and fitted into short handles. Quantities of them are used by porcelain manufacturers to burnish the gold after the ware comes from the kiln. Bookbinders, gilders, metal-plate-workers and the like employ them for

* Since writing this article I have thought that it is *possible*, I do not say *probable*, that the formation of the hæmatite may be accounted for in a third way, namely:—That the clay-ironstone nodules and their associated rock-fragments were subjected to *a heated chemical solution within an open fissure or fissures*, into which they had been drifted or thrown, which was sufficiently prolonged to render the alteration of the mineral matters more or less complete.—W. S. G.

getting their things up bright; though I understand that the grey agates and burnishers of steel have in late years taken the place of the hæmatite ones, owing to the former being less expensive; still, for certain purposes, the latter are found to be indispensable.

Whether any "ironstone jewellery" is made from these particular hæmatites I cannot say. English ores, I believe, are shipped to Germany, where they are cut by water-power, and sent back to England and sold by our jewellers under this name. At any rate this nodular ore is equal in quality and brilliancy to that which I have seen in the shops in Hamburg, London, and elsewhere. The ore is made up into lockets, seals, scarf-pins, ear-rings, and so forth. The value of the stones described in this notice depends of course upon size and soundness; a faultless lump weighing say from 12 to 15 ounces is worth from 15s. to 20s., but such as these are exceedingly rare; 2 ounce pieces are about the average, and are worth from 9d. to 1s. 6d. wholesale price.

With reference to the production of burnishers in the rough, years ago they were obtained in large quantities by systematic working—by underground mining and in open-casts. These workings were chiefly, if not entirely, carried on at Measham, in Derbyshire, which village is built upon the Permian beds. The *modus operandi* was somewhat as follows:—The site for the pits, &c., having been fixed, the ground was first marked out in plots of one hundred square yards each, for which a rent or royalty of £10 was paid to the landlord—equal to £484 per acre. Shallow pits, termed "wallow pits," were sunk to the burnisher-bearing bed. This occurred at from 10ft. to 20ft. deep, and usually about 12in. in thickness. The ground was then "pottered out" (excavated) all round the pit, the hæmatite being carefully picked out and the debris cast aside. One pit being exhausted of burnishers, another was put down beside it, the old one being filled up, and so on until the entire area was cleared. The stones were also obtained in the open-working system, and often occurred in patches or clusters rather than spread evenly through the mass. I cannot state what the yield per acre was, but that the business at one time was a very paying one is a fact. The selling price would be at the rate of between £100 and £200 per ton, but the stones were sold according to size and quality rather than by weight. Numbers of them have been picked from the beds of the streams in Measham, Packington, and Willesley. Also some valuable ones were formerly obtained clandestinely by men who went and grubbed them out of the ditches, &c., by night, with the

aid of candles, &c. The burnisher-miner, or rather hunter, carried a small hand-hammer about with him with which he tested every ore pebble for soundness as he proceded with his work. The grinding and getting-up of the stones for the trade was and is still carried on at Measham; the process being for many years kept very secret, a single individual having the monopoly of the business. At the Great Exhibition of 1851 this man obtained a prize for bloodstone burnishers.

6.—In concluding this paper I wish to draw the reader's particular attention to the following points above referred to, as I think they deserve in some respects a closer investigation than it has been possible for me to give them:—

1st.—It must be from a carefully conducted examination of the hæmatite, and especially of the associated rock fragments in the Permian breccia, that the locality or localities whence they were derived can be fixed. This is an important question for solution.*

2nd.—Our enquiries result in showing that a metallic mineral of very high qualities and of great purity is not necessarily devoid of fossils, or conversely that coal-measure fossils do not necessarily occur only in rocks composing those measures.

3rd.—That the coal measures have indirectly furnished us with a class of ore, the peculiar properties of which make it of special commercial value.

4th.—That external appearances in regard to these nodules, as in many other things, goes for very little, the water-worn aspect of them being very deceptive.

5th.—These stones afford an almost unique example of the process of pseudomorphism, or of the extent to which chemical action has gone on within a rock bed or a contained rock fragment, an instance, I take it, of actual movement of inorganic matter having taken place within a stratum or rock mass at rest, an instance also of the growth of a mineral in weight and in density though not in bulk. The whole series of stones afford us a very instructive example of the way in which a mineral, or rather a combination of minerals, pass by imperceptible gradations from the most earthy stage to a metallic mineral of nearly chemical purity.

* Since this article was written the author has been engaged in the collection of a series of these rock-fragments, a microscopic examination of which has been kindly made by Prof. Bonney, F.R.S., and he reports to me that he has detected fragments of rocks in them which he believes do not occur above ground anywhere in the country. We are still working at these most interesting fragments.—W. S. G.

6th.—The agate-like specimens are a study in themselves, and afford one of the most interesting examples it is possible to have of the delicately beautiful processes of mineralogical construction.

7th.—The magnetic properties displayed are not unworthy of investigation.

8th.—The author having had the good fortune to discover in these hæmatite fragments the remains of some exceedingly rare organic fossil remains (Arthropoda) hitherto almost unknown* in the district, it should stimulate us to still further work amongst them.

9th.—Certain of these specimens probably possess as interesting a history, and would furnish enquiring minds with subjects for almost endless investigation as valuable in a mineralogical point of view as any it would almost anywhere be possible to obtain. In other words, I maintain that the number of points or characteristics possessed by the "pebbles," viz. :—Origin,—removal at close of the Carboniferous period,—treatment in Permian times,—re-deposition,—chemical change,—magnetic properties,—concretionary agate-like and other structure,—striæ, and other super-induced features,—organic remains,—variety of structure, fracture, colour, &c.,—occurrence in the alluvium,—value,—and so on,—is probably as great and as varied as it would be the lot of few to study in any other geological specimens.

Lastly.—The author is indebted to several geologists and others who have kindly furnished him with ideas and information, enabling him to work out, so far as has been possible, the probable history of these burnishing pebbles.

A List of the Fossil Plant, &c., Remains Discovered in the Hæmatite Nodules of the Permian Breccia of Leicestershire.

Flora :—

Neuropteris subfalcata ?
N. gigantea.
N. tenuifolia ?
N. (possibly of three other species).
Pecopteris.
Asterophyllites foliosa ?
A. equisetiformis ?
Lepidodendron obovatum (leaf-scar of).
L. clypeatum ? (leaf-scars of).
L. (a third variety of leaf-scar).

* See Hull's "Leicestershire Coal Field," p. 26; and Molyneux' "Burton-on-Trent," p. 263.

Lepidophyllum ?
Lepidostrobus (macrospores of).
Sphenophyllum ?
Rhacophyllum ?
Trigonocarpum olivæforme ?
Sphenopteris ?
Cordiates.
Pseudopecopteris nervosa ?
Calamites cannæformis ?
Halonia ? (a tubercle of ?)
Odontopteris.
Tree-fern stalks ?
Seed-vessels ? (a group of).
Lycopodites vanuxemii ? Dawson.
Rootlet of Stigmaria ficoides ?
Fungus ? (two species).

Fauna :—

Anthracosia æquilinus ?
A. (another species).
Anthracoptera ?
Lingula ?
Rhynchonella ? R. Etheridge.
Entomostraca ?
Arthropoda (leg of an insect), H. Woodward.
A. (probably parts of two legs of a small scorpion-like form).
Fish bones ?
Worm castings of various dimensions.

THE PRINCIPLES OF BIOLOGY.

BY HERBERT SPENCER.

Exposition of Part III. Chapter V.

BY DR. WILLIAM L. HIEPE.

The first remarkable fact that arrests our attention in the study of embryology is expressed by Von Baer in the following words:—"In its earliest stage every organism has the greatest number of characters in common with all other organisms in their earliest stages; at a stage somewhat later its structure is like the structures displayed at corresponding phases by a less extensive multitude of organisms; at each subsequent

stage traits are acquired which successively distinguish the developing embryo from groups of embryos that it previously resembled, thus step by step diminishing the class of embryos which it still resembles; and thus the class of similar forms is finally narrowed to the species of which it is a member." But these resemblances are only general, and not special; for example, it would be wrong to say that the human embryo at any stage specially resembled a fish, but certainly it passes through certain stages during which it possesses more general characters which are also possessed by fishes and which it loses during its advance towards maturity. Examples of passing general resemblances to other classes could be easily found. But in many cases there are irregularities, and the embryo, instead of advancing to a likeness of a higher type, seems to be stationary, or even retrograding. But if we assume this development through stages to have some connection with the stages through which the ancestral races of the species have passed, we see clearly that it must be so, as the modification of organic forms is irregular and does not always imply a progress to higher forms. As we found that from the relations of languages we derived some good illustration of the facts of classification, it appeared to me interesting to try if the facts of embryology could be supported by ethnological facts. The development of an embryo is evidently analogous to the development of speech in an infant. Now it struck me as remarkable that in nearly all European languages the first words which an infant learns, those expressive of the names of the parents, "Papa," and "Mamma," are very much alike, even if the words for father and mother are different. And besides this we find that when children first learn to speak they do not form their sentences grammatically, but put the words together without any inflections. We find the same mere combining of words now in some Eastern languages, and it may have been the characteristic of some common ancestral language.

The next fact which we have to consider is the substitution and suppression of organs. In some cases the embryo, during some period of its development, possesses organs which the mature form does not possess; they are either reabsorbed, or their function is changed so that they discharge a different function in the mature stage. Sometimes they are only partly absorbed, and then form, in the mature animal, rudimentary organs. As an example, Mr. Spencer quotes the case of the development of an allantois in the mammalian embryo. This allantois is homologous to the breathing apparatus of birds and reptiles during their last embryonic stage. But in the

embryo of the mammal it serves no such purpose ; it is either reabsorbed, as in the implacental mammals, or it becomes placental—that is, it serves as a connection between the embryo and the parent animal for the admission of nutritive matter.

The development by different stages is called indirect development. But in some cases the germ forms itself almost directly into the form of the mature organism ; such development is called direct. Direct development is found among the spiders, some gastropods, and most of the lowest classes of animals, while the indirect development characterises the higher classes. On the theory of evolution the development of each organ must be a sort of condensed repetition of the development of that organ in the ancestral races, and must therefore be indirect originally. The direct method must therefore have been substituted for the indirect one wherever it occurs. To find the reason of this substitution, Mr. Spencer compares the embryonic development with the formation of social agencies. He shows that now such agencies as colonies, towns, mercantile associations, &c., are formed directly, while formerly they were formed indirectly and by degrees. The reason is that such agencies having been long established or being very prevalent, people's ideas have become changed, and they at once arrange themselves according to a finished plan instead of going through all the stages of development. In like manner we can explain the substitution of direct for indirect development ; as each organism consists of physiological units, these must be altered by external forces acting on and modifying the whole organism.

If these external forces cease to act, no modifications will take place, and a complete harmony between the action and re-action of the organism and its units will be established in time—that is, the units will be so modified as to shape themselves at once into the form of the organ or organism, and we have direct development; but continued action of external forces will prevent this harmony being established, and each modification of the organism, causing a modification in the units, will be inherited and reproduced during the development of the individual. From this we conclude that we ought to find development direct where the conditions have been most constant, and indirect where the modifications through which an organism has passed during its evolution from its ancestors have been numerous and great. This is what we find, as the low types which possess direct development show by their inferiority that since their first production they have not

undergone many changes. We have here also an explanation of the fact that the heart and other internal organs are more directly developed than the external organs, which are most exposed to the modifying actions of external forces. Thus all the remarkable facts of embryology are brought into harmony with the principles of the theory of evolution.

Chapter VI.

If we turn from the organisms in the stage of development to those which have already arrived at the stage of maturity, we find that sub-groups belonging to the same group as a rule are similar in their structure. Let us take the vertebrate animals as an example; there are the mammals, the birds, reptiles, fishes, and amphibia, all with the same structure of the vertebral column, ribs, and four limbs. The latter are not always directly recognisable, and in some cases are entirely wanting, but as a rule we can trace their rudiments or homologous structures. In the class insecta, which Mr. Spencer quotes, there is the uniform structure of twenty segments, which is also present in the crustaceans. Here the case is still more remarkable, as the number is always the same. Although sometimes they are difficult to make out, several segments having apparently united to form one, their presence can always be demonstrated. There are numerous similar examples in the animal and vegetable kingdoms.

Now, it is evidently absurd to suppose that such facts are the result of design of the Creator, or of chance, or of necessity ; but if we assume that the present organic forms have arisen by modification and divergence from common ancestral stocks, we at once understand these similarities and analogies as a sort of heirloom, or as characters belonging originally to the typical ancestors. We see thus that these facts not only offer no difficulty of explanation by the theory of evolution, but actually follow as a necessary consequence. The very exceptions seem to strengthen our argument. If there are such animals as the spiders, which have not twenty segments as they ought to have, it is easy to see that although the typical character of the progenitors has been retained by most of the descendants, in cases of exceptional modification even that may have undergone a change ; but a theory of design or necessity is at once made impossible.

There is more evidence of the same class in the similarity of structure between different organs of the same individual. Compare the structure of the human leg and arm, of the bird's leg and wing, of the finger and the toe,

and it seems surprising that organs of such difference externally, and of such different uses, should be constructed on so similar a plan. Look at the vertebral column of a man. One part, the sacrum, in which great strength is required, consists of five vertebræ consolidated to one piece, but still showing the divisions. The number of these divisions varies in different orders and even in the same order.

Can we suppose such structures to be the result of a design, or chance, or necessity? No. Here, as before, evolution is the only agency by which such a state could have been brought about.

In the last chapter we saw that during development an organism often requires organs which later on disappear, are absorbed, or replaced by other organs; but often they are retained and form then what are called rudimentary organs.

The examples of these are numerous; some snakes have rudimentary legs under the skin; smooth-skinned amphibia sometimes have rudimentary scales under the skin. In some birds the feathers are rudimentary and are reduced to simple shafts or even hairlike forms. Our own fine hairs covering the whole of the body are the rudimentary covering homologous to the hair of mammals.

There are numerous cases of rudimentary wings in insects, or wings uselessly hidden under firmly closed wing-cases. In the productions of artificial selection we often find such cases; rudiments of tails in tailless breeds, rudimentary ears or horns in breeds which are without these organs.

In all these cases an assumption of design would evidently be absurd, as likewise that of necessity, and we arrive again at the conclusion that they represent the signs of a kinship between the organisms which must be traced back to their common ancestors.

We have thus three points in which all theories but that of evolution fail: First, the unity of type in forms of great difference belonging to the same group; second, the similarity of structure in different organs of the same organism; third, the presence of rudimentary and useless organs; but all can easily be explained by the theory of evolution and follow as a necessary consequence of it.

Chapter VII.

In considering the facts of distribution as arguments for or against evolution we must treat separately distribution in space and distribution in time; further we have to distinguish, when investigating distribution in space, between that over

different areas in the same medium, and that over different media. The facts of distribution over different areas in the same medium are chiefly the following:—The fauna of a peculiar area is determined less by its fitness for certain types than by the possibility of its being populated from neighbouring areas. This is to say, we often find areas very much alike in climate, soil, and physical condition, but inhabited by quite different types, while on the other hand the same types are often found on areas differing very much in those respects. Now these facts at once contradict any theory of design.

If we consider the latent tendency of all organisms to extend their sphere of existence we shall be able to understand these facts better. Supposing an organism inhabits a small area and has arrived at a complete harmony with its surroundings. Then it will surely begin to spread over the neighbouring areas, where, in the struggle for existence with already established forms, modifications must be produced, and the result is that there are two closely allied forms of the same type inhabiting adjacent areas. And that is, in fact, exactly what we find in Nature. This spreading of organisms over new areas is very well illustrated by the spreading of European animals and plants in New Zealand, where they overrun the country to the extinction, in frequent cases, of the native types.

In the last case we assumed that there was no barrier to the spread of the organism. If there are such, the present state of the fauna and flora will entirely depend on the length of time these barriers have existed. If they had been in existence for a long time, we should expect that although before their appearance the faunas were closely allied, they will not be so now, as ample time has elapsed for their modification. The modifications will be the more important the longer the time that has passed since the last connection. We find very striking illustrations of these facts in the study of the fauna and flora of islands; such as the Azores have only a small number of different types, and all are allied to those of the nearest continents. In fact, the organic forms are only derived from chance arrivals from the shores of Africa and Europe. They are nearly all such forms as have special means of spreading or migrating, or, like birds and insects, are winged animals, which may be carried away by the wind. Some types are much modified, and they must be the descendants of continental forms which arrived there at a very remote time. Others are very little modified, and do not trace their pedigree quite so far back. Others, again, are

identical with continental species, and these are found among the regular arrivals from the continent during storms, and as the new arrivals mix with the natives they thus prevent modifications.

But if we take the fauna and flora of St. Helena, for example, we find that there are only very few species identical with continental ones; a greater part are allied forms, and the greatest proportion are entirely peculiar forms found nowhere else. The reason is that St. Helena is farther from any continent, and has never been in connection with one; while the Azores are at a smaller distance, and although perhaps they have never been in direct communication with the continent, it is possible that the distance at a remote period was smaller still, and broken by intervening islands.

From the principles of the theory of evolution we should also expect that those areas which have been isolated for the longest time possess the lowest types; and that is actually the case, as is shown by the peculiar fauna of Australia, almost the only country where the marsupials, the lowest type of mammals, are preserved.

There is also no difficulty in explaining the distribution of organisms over different media. As we find the lowest organisms in water, we must suppose that the beginning of life occurred in that medium, and we must explain how it was possible for organic forms to spread from water to land. The first beginning of a change in that direction might have been caused by agencies like the tide. Along the shores of the sea there is a large number of animals which regularly spend part of their life in water and part in air. There are fishes which fly through the air or climb trees; birds which dive. There are animals living in mud pools which during the dry season have to live without water. There are the amphibia, most of which can live in either medium, but some only inhabit one, although they are able to live in the other. We have thus a perfect gradation from animals entirely confined to water through such as can live in either to those which can only live in air; and that is just what we should expect, what is a necessity from the principles of evolution.

When we consider the distribution in time we find that the evidence is very scanty, but such as it is, it is entirely on the side of evolution. The fact that the difference in fossil remains is proportional to the difference in the time of their existence; the fact that species, genera, and entire types are extinct; the fact that the length of existence of a species does not necessarily imply a large amount of modification; all those facts are in harmony with the evolution theory.

Still more we recognise this harmony when we compare living types with types extinct. The types of the uppermost strata show the most resemblance to now living forms, and are often identical. The lower we go the greater is the difference between the then existing forms and the present fauna; the cases of identity become rarer, and the types become lower and less specialised; in some cases we can trace the whole pedigree of a now existing animal to the remotest ages. We also find that the fossil forms of one area correspond most closely to the living forms of the same area; while in many cases these living forms can be proved not to be specially fitted for that area, as is the case with the fauna of Australia for example, which disappears rapidly before the better fitted European fauna.

We come thus to the conclusion that the theory of evolution better than any other theory explains the remarkable facts of the distribution of animals and plants in space and time.

THE MONUMENTAL BRASSES OF WARWICKSHIRE.

BY E. W. BADGER, M.A.

(*Continued from page 84.*)

COMPTON VERNEY. I.—*Anne, dau. of Rich. Verney, Esq., and wife of Master Edw. Odyngsale, of Long Itchington.* 1523. *Haines.*

This effigy is 1ft. 10¾in. long, and represents a lady in the usual prayerful attitude. Upon her head is a kerchief, beneath which is a *wimple*, drawn closely under the chin, and covering the neck and sides of the face. A loose outer gown, with wide sleeves, is so draped at the left side (cf. the Aston brass) as to disclose a *kirtle.* Above the effigy is a small shield, 5½in. long, bearing part of the Verney arms: ar., three crosses moline gu., apparently quartering Green: three bucks trippant.

On a mutilated plate, 1ft. 8in. by 3in., below the figure is this inscription:—

**Off yeor charyte pray for the sole off Anne Odyngsa . . .
off mayster Edwarde Odyngsale off Longe ygyngeton . .
dogter of M Rycharde Verney Esquyer ye whyche deptyde
ye yere of o lorde mocccccxxiii o whose sole Jhū have mc̄y**

There were originally four evangelistic symbols, of which only one, that of S. Mark, is left, at the right hand top corner. Dugdale gives a fair illustration of this brass, but with different armorial bearings.

II.—*Richard Verney, Esq.*, 1536–7, *and w. Anne, with 9 sons and 5 daus. Haines.*

The effigies are about 1ft. 10in. high.

The husband, who is bare-headed and wears his hair long, is represented in armour rather different from any yet described. The *pauldrons*, or shoulder-pieces, are composed of plates arranged in ridges. The cuirass has a central ridge called a *tapul*, and a skirt of oblong plates, from which depend three *tuilles*, one at each side and one in front. Under these is a hawberk. The hands are encased in gauntlets of plate, which leave the fingers exposed. The sword is fastened to a belt hanging diagonally across the body. The *genouillières* have plates above and below them, and ornamental appendages at the sides. The greaves are prolonged over the ankles; the feet are covered by broad *sabbatons*, to which spurs are attached.

The lady wears the kennel-shaped cap, and an outer dress with tight sleeves, and wide-frilled cuffs. This dress, being cut low and square upon the chest, shows an under garment fastened at the neck with a button. The outer dress has a wide border, and is confined by a waistband with a rosette in front; it is gracefully caught up at the left side, showing an under skirt.

Above these figures is a shield, 8in. long, with Verney and Green quartered, six quarterings being now vacant. Below the figures are two groups of children. The daughters are dressed like their mother; the sons wear short dresses or kilts reaching to the knee, hose, and square-toed shoes. One of the boys wears a gypcière, and another has something like a Scotch *sporran* hanging in front of his kilt.

At the corners of the tombstone were evangelical symbols, only three of which are left. On narrow strips of brass round the edges of the stone is this mutilated inscription :—

Off your Charyte Praye for the soulles of
. . . . depted out of this psent worlde the xxviiith daye
of the monethe of September
in the yere of our Lord God mºccccc. . . . . .

Dugdale gives an illustration of this brass, with a different coat of arms, and says Richard Verney "was in that esteem with King Henry VIII. that, being informed of some infirmity

in his head, he afforded him a speciall licence . . that he should wear his bonnet at all times and in all places, as well in the king's presence as elsewhere."

III.—*Geo. Verney, Esq.*, 1574. *Haines.*

This is a figure 1ft. 10in. high, representing a man in armour of the seventeenth century; indeed, the effigy might be a portrait of one of Charles the First's cavaliers. His hair is long and curled; he wears a deep falling collar and trunk-hose. The most noticeable features of the armour are the pointed breast-plate, the large *tassets* over the thighs, the escalloped border of the lining of the *pauldrons*, and the numerous rivets with which the plates are fastened together. The sword-belt is arranged diagonally across the body, the sword has the modern guard, and the dagger is at the back of the figure. Apparently the knight wears jack-boots (which meet the *genouillières*), with spurs and spur leathers. The brass was evidently, as Haines says, engraved about 1630, *i.e.*, sixty years after Geo. Verney's death. (Compare the brass at Barton.)

Above the effigy is a fine shield, 8in. long, well engraved, with the quarterings of Verney, Lovell, Lucy, Green, Beauchamp, and others.

There is also this inscription on a plate, 8in. by 11in. :—

Here lies George Verney | of Compton Esq: sonne of Sr | Richard Verney Knight and | hvsband of Jane the davghter | of William Lvcy of Charlcot | Esq. by whome hee had one | sonne and fower davgh | ters. Hee died the eight | day of Aprill Anno Dni 1574.

Dugdale gives a fair representation of this brass, but with different armorial bearings.

There are several tombs in the church, with brass shields bearing the Verney arms.

Haines considers Nos. I. and II. the work of Warwickshire artists, and No. III. by the same artist as the brasses at St. Columb, Cornwall.

COUGHTON. I.—*Sir Geo. Throkmorton and w. Kath.* c. 1500. *Haines.*

Two effigies 3ft. high, of decidedly provincial workmanship. The knight's head rests upon his tilting-helmet, under which is a cushion. The helmet bears the crest an elephant's head sa., eared or. The epaulières have ridges called pass-guards to protect the neck, and upon the breast-plate is fixed a lance-rest. The coutes are heart-shaped and ornamented,

the two tuilles are fastened by straps to the cuirass and are scored to represent separate plates. The genouillières are absurdly large and have cuspidate edges.

The lady wears the kennel-shaped head-dress, a mantle fastened with a band across the chest, an under-dress with ornamental collar, and a loose twisted waistband with circular clasp and pendant ornament.

Above the knight's head is a shield bearing the arms of THROKMORTON: Gu., on a chevron arg., three bars gemel, sa. Above the lady's head is a shield with THROKMORTON impaling VAUX.

Beneath the knight are the effigies of 8 sons, and beneath the lady those of 11 daughters. Below the sons is a shield of four quarterings: 1 THROKMORTON, 2 OLNEY, 3 SPINEY, 4 ——. Upon the lady's side is a shield, THROKMORTON impaling ABERBURY.

Upon the sides of the tomb were four shields, two of which are lost, the two remaining bear the quarterings of all the families mentioned except VAUX.

The following is the inscription:

Of youre Charite praye for the Soule of syr George Throk= merton knyght, And dame Katheryn hys wyfe, one of the Daughters of syr Nycolas Vause | Knyght (Lord Harroden) Whyche syr George deceased the . . . day of | . . . In the yere of the incarnacyon of our lord god A mccccc . . . and dame Katyn dyed the . . . day Of . . . Ano mvc . . . on whose soule ihu have mcy amen.

Dugdale, who gives an illustration of this brass, states that the tomb was prepared in the knight's lifetime, which accounts for the omission of the dates.

II.—*Inscr. Dame Elizabeth Throkmorton last abbess of Denye.* 1547. *Haines.*

Upon a plate 20in. by 4½in. between four evangelical symbols is this inscription:

Off youre charite pray for the soule of Dame Elizabeth Throk= merton | the last Abbas of Denye, and aunte to syr George Throkmerton | knight, who decessyd the xiiith day of Januarye, In the yere of our | lord god a mccccxlvii, who lyeth here tumilate in thys tombe | on whoes soule and all chryssten soules Jhesu have mcy amē | ☞ vivit post funera vtus.

Above and below the inscription is a lozenge-shaped plate with the arms of Throkmorton. The brass has been restored.

III.—*Inscr.* *Sir John Throkmorton*, 1580.

A plate, about 21in. by 10in., upon the south wall of the chancel. It is not mentioned by Haines.

The inscription is in black letter, the letters being in relief, and runs:—

Here lieth interred ye bodie of Sir John Throkmorton knight of | Feckenham, the fivethe sonne of Sir George Throkmorton knight of | Covghton, somtime Master of ye Requests unto queene Marie of hap= | pie memorie, who in respecte of his faithful service bestowed upon | him ye office of Justice of Chester and of hir Covnsaile in ye marches of | Wales in wch rome he continewed xxiii yeares & supplied wth in ye | same time ye place of vice president ye space of iv years, he had to | wife Margerie puttenham Daughter of Robert puttehā Esquier | by whom he had Issue v sonnes & iiii daughters, he departed | this life ye 22 of May Ao 1580. his wife survivinge who lived | and died his widoe ye . . . and is here also interred.

Above this is a shield with the Throkmorton arms.

No. II. is upon an Altar-tomb at the north side of the chancel. Upon the same tomb is a brass cross and inscription to Sir C. Throkmorton, d. 1840, and an inscription to Dame Elizabeth Throkmorton, d. 1850.

(To be continued.)

Reviews.

Illustrations of British Fungi. Part XXXIX. M. C. Cooke. 8s. 0d. Williams and Norgate.

This part completes Vol. IV. of this very valuable work, and affords a favourable opportunity for calling attention to the great advance which has been made in the study of the fungi of late years, more especially since the publication of the "Handbook" in 1871. In that work, up to the point now reached in the "Illustrations," 433 species of the Agaricini are described and recorded as British species, and this was an advance, since the publication of Berkeley's "Outlines," of 90 species. The number now reached in the index of the "Illustrations" is 794, or nearly double the number of species recorded in 1871, and of these all but 54 are figured in this work. The four volumes before us contain 622 plates, upon which are given coloured figures of 740 species and varieties of the Agaricini. Of these, 24 are entirely new species or varieties, and at least 100 are species or varieties that have never been figured before. The true value of this work will be better understood by a comparison with the previous illustrated works on the fungi.

The species of the Agaricini figured by our most prominent British authors were Bolton, 108; Sowerby, 165; Hussey, 80; Berkeley, 93; Badham, 20; Saunders and Smith, 60; Price, 67; a total of 583. But many of these figures are merely repetitions, the same figure appearing over and over again in the various works. And whilst acknowledging our great indebtedness to these earlier authors for their valuable work, we cannot but feel how great an advantage it is to have, within the compass of one work, and that work costing less than such a work as that of Sowerby, illustrations far greater in number than are to be found in the works of all our previous authors combined. Then again these older works are not only costly but also rarely to be met with, and hence only few students could avail themselves of the valuable aid they afforded. The importance of illustrations in such a study as that of the fungi can only be appreciated by those who have given attention to the plants, so that this work of Dr. Cooke's may be said to have commenced a new era in this study. The great help afforded by this has encouraged our younger students to take up a study which before seemed to be surrounded by insurmountable difficulties. Hence, instead of mycologists being as heretofore a small and select band, we have now few field clubs in the kingdom in which there are not one or more of the members who devote themselves to this most intricate but pleasing study. A work which has brought about so great a result should surely be supported by every true lover of botanical science. From an announcement in "Grevillea" for March, we learn "that Part 40 of this work will commence with illustrations of the remaining genera of the Agaricini, and that about two more volumes will complete the present series." We can only express a hope that the talented author may have health and length of days to finish his great undertaking. J. E. BAGNALL.

The Birds of Lancashire. By F. S. MITCHELL, Member of the British Ornithological Union. London: John Van Voorst.

MR. MITCHELL aptly describes his book as "a chapter on geographical distribution." The author, however, does not merely record all the birds found in Lancashire, but also adds a large amount of information about their habits, time of breeding, migration, &c., so that in this respect the book is of more than local interest and may be consulted with advantage by all who are interested in the "Natural History" side of ornithology. In the case of the rarer species, localities and habitats are given, and the references to books and periodicals where their appearances are recorded range from Camden's "Britannia," 1507, to the "Birds of Europe," Dresser, 1883. In addition there are lists of local names, a good map of the county, some illustrations of birds and duck decoys, and last but not least, a reliable index. It is to be hoped that similar works for the other counties, written by competent naturalists, will soon appear.—A. B. B.

Lecture Notes on Physical Geography and Geology. By J. V. ELSDEN, B.Sc., and W. B. LOWE, M.A., F.C.S.; large 8vo., 106 pp., plates. Published by A. Percy Smith, Rugby, price 10/6.

THIS is without doubt the best resumé of that broad subject called Physiography with which we are acquainted. The first part of the book deals with the Earth as a planet; the Atmosphere; the Ocean; the Land; and the Classification and Distribution of Life. The second part is divided into Physical Geology, Structural Geology, and Palæontology.

The mass of matter relating to the subjects treated of is very large; it is skilfully arranged, and is at once compact and brief, yet intelligent and interesting. The authors have "sat at the feet" of Professor Judd at the Royal School of Mines, and Professor Bonney at Cambridge, and have evidently laid under contribution the lecture notes of these high authorities. One side of each leaf is left blank, so that the reader may add notes from his general reading, or from lectures which he may attend. As a guide to examination work in Physiography, &c., this is certainly an excellent book, but it is not the less valuable to the general reader for guidance or reference on the subjects to which it refers. W. J. H.

METEOROLOGICAL NOTES.—February, 1886.

The barometer was low on the 1st of the month (29·194 inches), but rose rapidly, with two slight checks, until the 9th, when the reading was 30·684 inches, thus covering a range of 1·490 inches in eight days. From this point a fall took place to the 14th, after which it gradually rose, and continued high until the end of the month. The mean temperature, 34·5°, is the lowest in February during the past eight years, and is about six degrees below the average. The maximum temperatures have been unusually low, the highest recorded being 50·1° at Loughborough, 49·0° at Henley-in-Arden, 48·8° at Hodsock, 48·6° at Coston Rectory, and 47·3° at Strelley, all on the 13th. In the rays of the sun, 93·9° at Hodsock on the 26th, 88·3° at Loughborough on the 27th, and 81·4° at Strelley on the 1st. The lowest readings were 19·5° at Coston Rectory on the 27th, 20·7° at Hodsock on the 7th and 27th, 21·9° at Loughborough on the 15th, 22·0° at Henley-in-Arden on the 7th and 24th, and 22·1° at Strelley on the 7th. On the grass, 13·0° at Hodsock, 18·9° at Strelley on the 27th, and 19·7° at Loughborough on the 15th. The number of nights below 32°, in the air and on the grass, were respectively—Strelley, 23° and 26°; Hodsock, 19° and 25°; Loughborough, 18° and 25°. The rainfall was very slight, the total values of rain or melted snow being—1·19 inches at Henley-in-Arden, 0·39 at Hodsock, 0·38 at Strelley, 0·32 at Loughborough, and 0·25 at Coston Rectory. These amounts are less than in any February of the last ten years. Sunshine was deficient.

Wm. Berridge, F. R. Met. Soc.

12, Victoria Street, Loughborough.

EARTH TEMPERATURES AND WEATHER IN SOUTH AUSTRALIA.

BY CLEMENT L. WRAGGE, F.R.G.S., F. R. MET. SOC.

At my Torrens Observatory, situated on the plains two miles north-east from Adelaide, I give special attention to the matter of earth temperatures, and have records from depths greater than at other observatories in Australia as far as I am aware. The following

statistics will be of interest to my meteorological friends, and prove by the rise at the lower depths the abnormal force of the heat-waves recently experienced on the Adelaide Plains. The earth temperatures are taken, as soon as practicable, after the ordinary 9 a.m. observations:—

	February 1st, 1885.	February 1st, 1886.
At 1 foot	80·4	76·0
At 2 feet	79·3	78·1
At 4 feet	75·5	76·2
At 6 feet	71·5	73·5
At 8 feet	69·0	71·9
At 10 feet	68·1	71·2
At 12 feet	66·5	68·2

During January, 1885, the air maxima ran over 95°, but 100·0 was not reached. During January, 1886, maxima of 100·6, 105·2, and 111·6 were registered in my enlarged Stevenson's screen; the latter value occurring on the 4th. At 3 p.m. on that day the dry bulb read 109·7, wet 75·9, giving the enormous difference of 33·8; and a relative humidity or fraction of saturation of only 15 by Guyot's formula. At 3 a.m. on the 3rd inst. my electric hygrometer read—dry bulb 49·6, wet 48·6, giving 93 as a percentage of humidity. Can we have a better instance of the extraordinary vicissitudes of the South Australian climate? Nothing like it have I experienced during all my recent wanderings in Queensland.

Adelaide, February 8th, 1886.

Natural History Notes.

New Aquatic Moss.—Prof. J. B. Schnetzler describes a Moss attached to pieces of limestone found by fishermen in their nets, when fishing at a depth of 200m., at a particular spot in the Lake of Geneva. No fructification has yet been found on it, but the author considers it as probably allied to *Hypnum* (Thamnium) *alopecurum*, which it resembles in its mode of branching, and in the form of its cells. It is multiplied by green shoots, and the leaves contain abundance of chlorophyll and starch. Assimilation and the formation of chlorophyll therefore take place at a depth which marks the extreme limit of the sun's rays.—*Jour. of Mic. Soc.*, Feb., 1886, from *Bot. Centralbl.*

Meteors.—A meteor shower, radiating from the constellation *Andromeda*, may always be observed more or less during the last week of November. The *Leonids* appear about the 13th of November, and the *Andromedes* from a week to a fortnight afterwards. These latter are supposed to be connected with Biela's comet. They are often seen in small numbers for several nights in succession, but on the night of the 27th of November this year they came out with most unusual splendour. From about six to eight p.m. there was a perfect rain of meteors all round the heavens, the radiating point being almost exactly in the zenith. Between eight and nine the sky became cloudy, but I am told that it cleared up after midnight, and that the shower was still proceeding. It was not equal in grandeur to the display of the *Leonids* in 1866, but was, nevertheless, a very striking and beautiful phenomenon.—F. T. Mott, Birstal Hill, Leicester, November 28th.

STYLES OF INDIAN CORN FOR EXAMINING MOVEMENT OF PROTOPLASM. —Prof. C. E. Bessey recommends the long styles of Indian corn for the study of the movements of protoplasm. By taking a young style from an ear which has been kept in a warm place for an hour or so, clipping off a piece a couple of inches in length and carefully mounting it in water under a large cover-glass, there will be no difficulty in seeing a great deal of activity in the protoplasm. Care must of course be taken to have the style lie flat, remembering that it is not cylindrical, but somewhat ribbon-shaped. The cells are much elongated, and the walls are so transparent that with careful focussing their contents may be seen, even in the interior parts of the style. The protoplasm is sufficiently granular to be easily seen. It moves along the side of the cell in a strong steady stream, occasionally heaping up a great mass, which is eventually pushed onward by the current. As an easily obtained and instructive example of protoplasmic activity, the Professor knows of nothing which is superior to such a specimen.—*American Naturalist*, 1885, *p.* 888.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—BIOLOGICAL SECTION, March 9th.—Mr. W. P. Marshall in the chair. Mr. W. B. Grove, B.A., exhibited a microscopical preparation of *Peziza nivea*, a fungus collected at Shirley by Mr. J. Morley; Mr. Charles Pumphrey, photographs on glass of an abnormal foxglove recently exhibited by Mr. W. H. Wilkinson; Mr. J. E. Bagnall, A.L.S., mosses, *Hypnum sericeum*, *H. cupressiforme*, var. *filiforme*, and *Racomitrium lanuginosum*, from Dartmoor; also a fine collection of plants from the Western and Eastern States, U.S., and Norway, representing the natural order Cruciferæ, from the herbarium of Mr. J. B. Stone, J.P., F.G.S., giving also notes on their generic distinctions and their geographical distribution. Professor Hillhouse, M.A., exhibited six microscopic slides illustrating the mechanical structure of the mid-rib of *Scolopendrium vulgare*, the Hart's-tongue fern. These were sections taken from the mid-rib and stalk of the frond, at intervals of 1½in., and illustrated beautifully the gradual development of the mechanical structure. Professor Hillhouse gave an interesting and lucid description of the structure, illustrating his remarks with black-board diagrams.—MICROSCOPICAL AND GENERAL MEETING, March 16th.—Mr. R. W. Chase read a paper on the "Petrels and Shearwaters," describing the habits of the birds, so far as they are known, and the breeding stations in Great Britain of the different species; he exhibited the following specimens in illustration of his paper:—*Procellaria pelagica*, also egg, stormy petrel; *Procellaria leucorrhoa*, Leach's petrel; *Puffinus anglorum*, also egg, Manx shearwater; *Fulmarus glacialis*, Fulmar. Mr. J. Levick exhibited, in illustration of pond life, *Brachionus urceolaris*, *Melicerta ringens*, *Hydra vulgaris*, Floscules, Entomostraca, &c. Mr. J. Morley made some remarks on the fact that rotifers have the power of retaining their vitality even when dried for months, or of being heated to 200° Fahr., and discussed the theory of their being sealed by the gelatinous mass which surrounds them. In support of the

theory which is now generally accepted, he exhibited some specimens of *Philodina roseola*, which had been dried on paper and sent to him per post by Rev. E. J. Holloway, of Clehanger, and some of which being revived by placing in water could be seen under the microscope in the full vigour of life. Mr. T. Bolton exhibited *Cordylophora lacustris*, also various freshwater diatoms, including some fine *Nitzschia sigmoidea*. —Sociological Section, March 18th.—Mr. F. J. Cullis discoursed on Part IV. of the second volume of Mr. Herbert Spencer's "Principles of Biology" on "Morphological Development," passing in rapid review the opening chapters on "Morphological Composition of Plants and Animals," dwelling at length on the later chapters on "Morphological Differentiation," and expounding exhaustively the thirteenth chapter on "Morphological Differentiation in Animals." His most interesting and lucid address, of an hour-and-a-half's duration, was listened to with close attention by the members of the section present. In illustration of the modification and differentiation produced by environment, Mr. W. R. Hughes, F.L.S., president of the section, exhibited under the microscopes specimens of *Palæmon serratus*, the common prawn, and of *Bopyrus squillarum*, its parasite, both of which it is assumed have originated from a common progenitor.

BIRMINGHAM MICROSCOPISTS' AND NATURALISTS' UNION.—February 22nd. Mr. Moore showed the following land and freshwater shells from America:—*Helix albolabris*, *H. alteriata*, *H. manselen*, and *Limnophysa reflexa;* Mr. C. Neville, specimens of tufa and fossil wood from Portland; Mr. Evans, transverse section of the jaws of an ichthyosaurus, the intermediate space being filled with iron pyrites. A paper was read by Mr. Hutchinson on "Yeast fungi and their functions," which reviewed the history of observations on this subject, showing that although the minute cells of the yeast plant were known in the seventeenth century, really accurate knowledge could only be gained after great improvements in the microscope. The paper described the yeast of commerce as mainly a Continental product. The various forms and sizes of cells were spoken of as being largely dependent on the suitableness of the fluid they lived in; the small oval cells were said to be most valuable for bread making. The paper was illustrated by experiments and specimens of the plant under the microscope.—March 1st. Mr. J. E. Bagnall presented to the society a copy of his "Handbook of Mosses." Under the microscope Mr. Hawkes showed *Ræstelia cornuta*, on mountain ash leaf, from Scotland; Mr. J. W. Neville, gizzard of mole cricket, *Gryllotalpa vulgaris*.—March 8th. A paper was read by Mr. Evans on "Volcanoes and volcanic action," describing the many erroneous ideas respecting them that had come down to us from olden times. A volcano was simply a fissure in the earth's crust where a molten interior found a vent. The phenomena of an eruption were described, Stromboli (which was said to be a pocket edition of a volcano) being given as a type. Volcanoes were either active, quiet, or extinct; the number of the first was computed at about 320. The paper reviewed the different theories of volcanic action as coming within the province of the astronomer, chemist, and geologist, and concluded by showing that evidences of eruptions were as old as the world, and that these furious outbursts were only specks in the universe on which all mankind depends. The paper was illustrated with diagrams, minerals, &c. A discussion closed the meeting.—March 15th. Mr. Collins exhibited a collection of minerals, including

specimens of opal, chalcedony, amethyst, &c.; Mr. A. T. Evans, an ammonite showing nacre of shell; Mr. H. Hawkes, a collection of seaweeds and zoophytes; Mr. C. F. Beale, specimens of trilobites from the American Silurians, probably species of Calymene. Under the microscope Mr. Moore showed a series of preparations of the larva and imago of *Dytiscus marginalis*; Mr. H. Hawkes, slides of *Sporendonema muscæ* on the house fly, and *Achlya prolifera* on larva of *Corethra plumicornis*.

LEICESTER LITERARY AND PHILOSOPHICAL SOCIETY. Section D, Zoology and Botany.—Chairman, F. T. Mott, F.R.G.S. Monthly Meeting, Wednesday, March 17th. Atttendance, eleven (two ladies.) The Chairman urged the members to make notes of their observations of plants and animals, and to send such notes to the "Midland Naturalist" for publication. Dr. Finch undertook to try the experiment of keeping a daily diary for the record of observations in the various branches of natural history, to be presented to the Section at its monthly meetings. Mr. F. Bates suggested that objects brought for exhibition should be accompanied by written notices of them, some of which would be acceptable to the "Midland Naturalist," and he illustrated his excellent suggestion by exhibiting specimens of *Nostoc*, and reading a short description of this interesting alga. Mr. Bates also exhibited specimens of diatomaceous earth from eight different localities in North America, some of which was distributed among members who desired it. The Chairman read a paper on "Scale Insects," illustrated by drawings of a *Coccus* infesting the White Abutilon, in the various stages of its life. He pointed out that the *Coccidæ* had been very little studied in this country, that there was no English work upon them, that the standard authority was the French monograph by Signoret, and that there was here a wide field for original research. Mr. W. A. Vice exhibited several species of *Coccus* on twigs of vine, peach, and apple,

PETERBOROUGH NATURAL HISTORY, SCIENTIFIC, AND ARCHÆOLOGICAL SOCIETY.—February 18th. Geological Section.—Chairman, Mr. E. Wheeler. Portion studied, Lyell's "Student's Elements," chap. viii.—February 25th. Botanical Section.—Address by the Chairman, Mr. J. W. Bodger, "On the different forms of stems, aerial and subterranean," illustrated with the runner or flagellum of the strawberry, the offset of houseleek, the stolon or stole of carnation, the sucker in rose and mint, the rhizomes of iris, and of Solomon's seal, the latter showing scars; various forms of pseudo-bulb of orchids and cacti, also procumbent, decumbent, ascending, scandent, and twining stems; the sobole in *Carex arenaria*, tubers of potato and artichoke; scaly bulbs of lily and tunicated of onion; corm of *Colchicum autumnale*; also cirrhi or tendrils of vine and passion-flower, leafy thorns of sloe, phyllodes of Ruscus and of *Acacia heterophylla*, the latter terminating with a bipinnate lamina.—March 4th. Geological Section.—Chairman, Mr. E. Wheeler. Lyell's "Elements of Geology," chap. ix., read and discussed.—March 11th. Botanical Section.—Address by the Chairman, Mr. J. W. Bodger, "On the form of the mature leaf, stipules, ligules, and venation, illustrated with specimens of *Tilia Europœa*, *Dactylis glomerata*, *Heracleum sphondylium*, *Juncus conglomeratus*, *J. effusus*, *Plantago major*, *Astragalus glycyphyllos*, *Vicia hirsuta*, *V. sepium*, *Stachys palustris*, *Orchis pyramidalis*, and other plants; also specimens of *Anemone pulsatilla*.

A HALF-DAY'S RAMBLE IN THE ARROW DISTRICT.

BY JAMES E. BAGNALL, A.L.S.

One of my first rambles for the present year was in the Arrow district, from Studley, through Spernal, Morton Bagot, Mapleborough Green, and Ipsley, to Redditch; a beautiful district, enclosed on the east and south-east by the high lands of the Alne Hills, Spernal Park, and the woodlands about Morton Bagot. These are in part the watershed of the Arrow, which was at the time of my visit a turbid, rapid stream. My desire was to work more fully the moss flora of this district, to note its boundaries, and to get some general idea of its physical features. My work began as soon as I left the railway station at Studley, the footways and banks being verdant with mosses. The first to be noticed were *Funaria hygrometrica* and *Ceratodon*, intermingled with the straggling stems of *Plagiochila bidentata;* on the banks, the fisherman's favourite, *Hypnum purum;* flattened patches of *H. denticulatum*, velvety patches of *H. velutinum*, straggling masses of *H. rutabulum*, silky tufts of *Dicranella heteromalla*, and here and there closer search revealed the beautiful fern-like *Fissidens bryoides*, whilst in the drains its more robust congener, *F. taxifolius*, was abundant, but rarely fruiting. Near Spernal Ash I noticed some patches of a dark, shining, green moss, with peculiar incurved branches, which I afterwards found to be *Scleropodium illecebrum*. This I had never seen in the county before; it is a moss more often found in maritime situations than in inland districts. In the lane leading to Spernal I noticed the polypody, *Polypodium vulgare*, very abundant, and its frequent companion, *Arum maculatum*, and on reaching the Arrow, which runs through this village, I found the trees on the river side well clad with the mosses more usual in such places, such as *Leskea polycarpa*, in abundant fruit; *Tortula mucronata*, *Scleropodium cæspitosum*, both very local mosses; *Tortula lævipila*, and *Orthotrichum affine;* higher up the river at Washford, I found *Tortula papillosa* in scanty patches, *T. subulata* growing in abundance in the mud left by the stream on tree roots; with this an abundant growth of *Didymodon rubellus*, with old capsules; large tufts of *Tortula insulana* and *Homalia trichomanoides*. I also noticed at Spernal that form of *Orthotrichum affine* which more nearly approaches the rarer *O. rivulare* in size and habit; *O. Lyellii* in abundance, and the leaves richly clad with the articulated bodies (*Conferva orthotrichi*) by which it is usually propagated; and its frequent companion, *O. diaphanum*. On the wooden bridge over the

river were minute tufts of *Weissia cirrhata*, and on the river bank, *Hypnum ruscifolium*. From Spernal I went past Spernal Park to Greenhill Green, gathering on my way *Bryum murale*, and noticing large tufts of *B. capillare* and small tufts of *B. cæspiticium*, and in the wood by Spernal Park the beautiful flowers of the primrose and anemone, always welcome as harbingers of spring. Here also I noticed fine masses of *Hypnum splendens*, as proliferous a moss as is *Thuidium tamariscinum*, which was also in abundance. On some of the footways *Hypnum squarrosum* was the only moss to be found, but the banks were rich in variety; among others *Atrichum undulatum* and *Weissia viridula* were noticeable. In the wood I found an abundance of the common scale-moss, *Plagiochila heterophylla*, *Polytrichum commune*, *Dicranum palustre*, and *Mnium hornum*. The trees about Greenhill Green were not only well clothed with lichens, such as *Parmelia saxatilis*, *Evernia furfuracea*, *Ramalina farinacea*, and *R. fraxinea*, but were also the habitats of the squirrel tail moss, *Leucodon sciuroides*, *Tortula ruralis*, and the beautiful *Zygodon viridissimus*, which is quite abundant in the district. At Greenhill Green there is some elevated land which appears to be the remains of an old heath; it has been at one time marshy, I think, judging by the mosses I noticed there. These were *Hypnum cuspidatum*, quite a prevailing moss; *H. molluscum*, with its pretty shell-like foliage; *H. stellatum*, a few isolated patches of *H. falcatum* and *H. filicinum*, and dark brownish-green tufts of *Tortula fallax* and *T. spadicea*. In a wood near Spernal Park I came across a splendid crop of *Helleborus viridis*, apparently thoroughly naturalised; this is a very rare plant in the county, and I considered it my best find, and searching the wood more thoroughly I found masses of the tree-like *Thamnium alopecurum*, and a most unusual moss in woodlands in this county, *Grimmia apocarpa*. The trees were well clad with such mosses as *Isothecium myurum* in good fruit, *Hyp. cupressiforme*, and its close ally *H. resupinatum*, and the very noticeable *Dicranum fuscescens*, this being new as a record for the Avon basin. I also gathered a fine patch of *Fissidens incurvus*, and saw an abundant growth of *Hypnum triquetrum*, a moss much used in Christmas decorations; its natural colour, the red stem showing so beautifully through the golden leaves, appears so appropriate that it seems a sad perversion of taste to dye this moss the unnatural colours one sees, often deep blue, and who can imagine a blue moss? On the trees in the lanes about Morton Bagot I gathered *Hypnum serpens*, *H. confertum*, *Tortula unguiculata*, and saw the pale green masses of that peculiar hepatic, *Metzgeria*

furcata, isolated tufts of *Radula complanata*, and the purple patches of *Frullania dilatata*, and now and again, but more rarely, *F. tamarisci*. Making my way over Out Hill and by Lower Skilts to Ipsley, I found in a tuft of *Hyp. Swartzii* a few isolated plants of *Fossombronia pusilla*, a very local hepatic in this county, and on the bridge over the Arrow at Ipsley *Tortula revoluta*, *T. muralis*, and *Grimmia pulvinata*. I might probably have added still more to my list, for the district is evidently a rich one, but the light began to wane and the mosses were unrecognisable, and though I could have wished for a longer spell of light, I felt I had done fairly well, and had been so well occupied that time had fled more rapidly than I had thought. To those who look with contempt on these studies, it may seem that I had taken a great deal of trouble for very little good, but to such I would reply, in the words of Southey, "Do not depreciate any pursuit which leads men to contemplate the works of their Creator! The Linnæan traveller who, when you look over the pages of his journal, seems to you a mere botanist, has, in his pursuit, as you have in yours, an object that occupies his time and fills his mind, and satisfies his heart. It is as innocent as yours, and as disinterested, perhaps more so, because it is not so ambitious. Nor is the pleasure he partakes in investigating the structure of a plant less pure or less worthy than what you derive from perusing the noblest productions of human genius."

THE MIDDLE LIAS OF NORTHAMPTONSHIRE.

BY BEEBY THOMPSON, F.G.S., F.C.S.

PART II.

Palæontology.

(Continued from page 77.)

In dealing with the stratigraphy of the Middle Lias of Northamptonshire, as will have been observed, I have endeavoured to trace, not only the zones, but the separate beds over a rather large area. My success has not been equal to my wishes; nevertheless, it has added considerably to the interest of the work, and may be of some use to future observers. It is not usual to be so particular in giving lists of fossils from the separate beds as I have been, so a few remarks as to the reason for it seems called for.

In studying the lower beds of the Upper Lias in Northamptonshire and some other districts, I have been led to the conclusion that the hard beds have a peculiar significance—that in fact they form the boundaries of distinct palæontological zones. Thus, at the base of the Upper Lias we have a paper shale in which *fish remains* are common, and at or near the top of this deposit occurs a limestone band in which they are exceedingly abundant. The hard bed is called the Fish and Insect-bed, or with us, insect remains being rare, simply the Fish-bed, and although for a few inches above fish fragments may still be met with, the limestone band practically forms the upward limit of the Fish and Insect Zone. Next we have in Northamptonshire a clay, with very few fossils, capped by another limestone band containing "*falcifer*" *ammonites* in enormous numbers. This bed, locally named the Lower Cephalopoda-bed, forms the upper boundary of the "Serpentinus-beds." Above this again is a clay containing great numbers of small ammonites, chiefly *A. communis* and *A. Holandrei*, with another limestone band at the top, in which they are, in places, still more abundant. This latter bed, which we call the Upper Cephalopoda-bed, forms the upper boundary of the "Communis-beds"; above it there is scarcely a fossil to be found for a considerable thickness.

There is no progressive increase noticeable in the number of ammonites and other fossils as we approach the limestone bands from below; hence it seems necessary to assume a scarcity of sedimentary matter during their formation, the shells of marine animals, chiefly ammonites, themselves constituting, in many cases, the greater portion of the bed.

The question as to whether the change in the fauna which took place at the end of each period was brought about during the cessation of deposit, or when the fresh sediment was introduced, can be fairly well decided in favour of the latter view, because there is a noticeable lingering of certain forms of fossils just above two of the hard beds, though only for a few inches.

It seemed to me probable that the hard beds of the Middle Lias might have a similar significance, and I think they have, though to a less noticeable extent. There certainly is a large increase in the number of fossils in the hard beds as compared with the soft ones below them respectively, and each one forms the upper boundary of one or more fossils, and the place of maximum development of perhaps several others for this neighbourhood, though of course out of this district they may be found higher or lower according to the direction in which migration took place.

It is important to notice that the lower beds of the Upper Lias were formed whilst the area was sinking, whereas the land was pretty certainly rising during the latter portion of the Middle Lias period. In the former case, therefore, fossils from remote districts would successively be introduced; in the latter the area of deposit would become more and more restricted, and so the introduction of new forms more difficult. This seems at first entirely opposed to the fact that there are a good many *characteristic* fossils in the Rock-bed and Transition-bed. Two suggestions may be made to account for them. One is that these fossils were present in the Middle Lias before, though scarce, and that their large numerical increase was a result of restricted migration; the relative abundance of species of Brachiopods in the Rock-bed and Gasteropods in the Transition-bed being a result of altered though not necessarily unsuitable conditions. The second explanation I would suggest is that the land was sinking during the period marked by the deposition of the sandy micaceous beds of the "*Margaritatus*" *Zone*, reaching its greatest, though never very great depth, when the impervious clays just below the Rock-bed were deposited, and that this was the time when the Brachiopods and other fossils were introduced, after which the land commenced and continued to rise to near the end of the Middle Lias period. The similarity of the "*Margaritatus*" *Zone* to the lower part of the Upper Lias in the frequent alternation of hard and soft beds, and in the distribution of fossils in them, seems to favour this latter view.

Of course if the theory of palæontological zones being bounded by hard stone beds, which I have sketched out here, has any truth in it, the bed which I have placed at the base of the Middle Lias could scarcely be the commencement of a zone, though it might be the termination of one. I must confess the belief is growing with me that the "*Margaritatus*" *Zone* must include the clay bed immediately below "L." This would alter the boundary between the Middle and Lower Lias, as drawn by the Geological Survey, so I hesitate to make this change without some better reason than that of a theory only imperfectly worked out.

There are certain well-marked palæontological differences between the three zones of the Middle Lias we are concerned with. The "*Margaritatus*" *Zone* is characterised by Lamellibranchs; the "*Spinatus*" *Zone* by Brachiopods; and the "*Transition-bed*" by Gasteropods. These differences are much more evident to those practically acquainted with the

beds than to those simply studying the list of fossils from them, owing to the abundance of individual specimens of common forms rather than distinct species.

So far as my own observations go, bed "L" is the highest in which *Avicula cygnipes* and the very large specimens of *Pecten liasinus* occur. *Limea acuticosta* reaches its maximum development in the beds "I," "J," "K," and then rather rapidly declines in numbers; the same remark applies to *Unicardium globosum*. *Pholadomyas* are met with in greatest abundance in bed "H," but above this they are comparatively rare. Bed "F" seems a very decided boundary for a number of fossils. *Ammonites margaritatus*, *Pleuromya costata*, *Cardinia antiqua*, *Cardinia lævis*, *Goniomya heteropleura*, and *Arcomyas* practically finish in it, only stragglers of any of them being found above. "D" is the highest bed in which I have found *Pholadomya ambigua* and *Cardita multicosta*, and the lowest for *Pecten textorius*.

The Rock-bed "B" contains a good number of things not yet found in any of the lower beds—*Ammonites spinatus*, *Hinnites*, *Pectens*, *Limas*, *Spiriferinas*, and enormous numbers of *Brachiopods* of the classes *Terebratula* and *Rhynchonella*, of which I have not found even the genera in the "*Margaritatus*" *Zone* of Northampton.

I need not here enumerate the fossils peculiar to the Transition-bed "A," because they are numerous, and the table of fossils to follow will sufficiently show them. Whether we regard the Transition-bed as a separate bed or only a modification of the Rock-bed, there is certainly as much difference between it and the true Rock-bed—palæontologically—as between any of the Middle Lias beds.

The following fossils have a considerable vertical range, passing through all or nearly all the beds:—*Ostrea cymbium*, *Pecten liasinus*, *Pecten æquivalvis*, *Limea acuticosta*, *Plicatula spinosa*, *Avicula inæquivalvis*, *Astarte striato-sulcata*, and *Protocardium truncatum*.

(To be continued.)

Colours of Flowers.—The shades of red and brown in the leaves of zonal pelargoniums are due to the same colouring matters as are found in the flowers of those plants. Hence when the flowers are picked off, which is a common practice with gardeners, the tints of the leaves become more brilliant, because they then monopolise the whole supply.—H.

Dressing for Insects.—Mix nine parts of benzole with one part of carbolic acid. This may be lightly brushed over the insects with a camel-hair brush. Beetles, &c., may be dipped in bodily, and the excess fluid removed with the brush.—H.

THE MONUMENTAL BRASSES OF WARWICKSHIRE.

BY E. W. BADGER, M.A.

(Continued from page 110.)

COVENTRY, St. Michael's. I.—*Maria Hinton,* 1594, *with four infants.* *Haines.*

The plate containing the figures is 8½in. by 11in.; that with the inscription 1ft. 4½in. by 11in.

The lady is represented as kneeling at a prayer-desk, upon which is an open book. She wears a high-crowned hat with curled brim, and ruffs at the neck and wrists (?). Her over-gown has a wide turned-back collar and plain skirt, and is confined at the waist by a belt. It is sleeveless, and allows the striped sleeves of the under dress to be seen.

Upon a tiled floor near the prayer-desk lie four infant children in *chrysoms* and swaddling clothes. The chrysom was a "white cloth with which children were invested" at their baptism. If the child died before it was a month old the chrysom became its shroud. Swathing-bands were wrapped round the under clothes, giving the child the appearance of a mummy. These children all died in their infancy. The inscription is:—

MARIAE HINTON FAEMINAE LECTISSIMAE
VXORI DILECTAE PROBAE ET PIÆ MARITVS
AMORIS HOC SVI MONVMENTVM POSVIT.

Quæ pietatis eras, quæ relligionis amore,
Et matronali cunctis gravitate probata,
Vivens et moriens constans exemplar amicis
Vivendi in vita, moriendi in morte relinquis.
Sic tibi, sic vivit vitae bona fama peractae;
Sic tibi, sic vitae constat spes viva perennis.

OBIIT ANNUM AGENS TRICESSIMUM
APRILIS 27°, 1594.

Translation:—To Maria Hinton, a woman of a thousand, a wife beloved, righteous, and dutiful, her husband has set up this memorial of his affection.

Approved by all for holiness of life
And love, and all that can adorn a wife,
Alive or dying thou dost ever give
A pattern how to die and how to live.
Thus lives thy good report of life well passed,
And certain hope of life that aye shall last.

She died in her 30th year, April 27th, 1594.

Maria Hinton was the wife of Dr. William Hinton, Vicar of St. Michael's and Archdeacon of Coventry. (Sharp's Antiquities of Coventry, p. 12, and Poole's Antiquities, pp. 138-9, where an illustration of this brass is given.)

II.—*Ann, w. of Wm. Sewell, Vintner*, 1609. *Haines.*

Like the above, this brass consists of two plates; the upper being 11in. by 8½in., the lower 1ft. 4½in. by 8½in. The lady kneels upon a tiled floor before a prayer-desk. She wears a high broad-brimmed hat, wreathed round the crown. This is worn over the "Paris head," "a kind of close linen cap projecting forward at each side of the face, often with . . . a lappet dependent behind" (Haines). Round the lady's neck is a large ruff; her dress has tight sleeves, a plaited stomacher, and plain skirt.

To her memory is the following inscription :—

HER ZEALOVS CARE TO SERVE HER GOD
HER CONSTANT LOVE TO HVSBAND DEARE
HER HARMELES HARTE TO EVERIE ONE
DOTH LIVE ALTHOVGH HER CORPS LYE HERE
GOD GRAVNTE VS ALL WHILE GLASS DOTH RV
TO LIVE IN CHRIST AS SHE HATH DONE.

ANN SEWELL Yᴱ WIFE OF WILLM SEWEᴸᴸ OF THIS CYTTY VINT
NER DEPTED THIS LIFE Yᴱ 20ᵀᴴ OF DECEM : 1609 OF THE AGE OF
46 YEARS ; AN HVMBLE FOLLOWER OF HER SAVIOVR CHRIST
AND A WORTHY STIRROR VP OF OTHERS TO ALL HOLY VERTVES.

Illustrations of the brass will be found in Bloxham's Mon. Arch., p. 254, and Poole's Antiquities of Coventry, p. 138.

III.—*Inscription. Captain Gervase Scrope*, 1705. *Mural.*

This memorial, not mentioned by Haines, is upon a large plate, 2ft. 2in. by 1ft. 10in., within a moulded stone border. At the top is a small shield, with the arms of SCROPE, az., a bend or., and the legend, *non haec, sed me.* Then follows :—

Here lyes the Body of Captⁿ. GERVASE SCROPE of the Family
of the SCROPES of Bolton in the County of York who
departed this life the 26ᵗʰ day of Augᵗ. Anno Dni 1705
Aged 66

AN EPITAPH Written by Himſelf in the Agony and
Doloroᵛˢ Paines of the Gout, and dyed soon after.

Here lyes an Old Toſsed TENNIS BALL,
Was Racketted from Spring to Fall
With so much heat and so much haſt,
Time's arm for shame grew tyr'd at laſt.

Four kings in CAMPS he truly seru'd
And from his Loyalty ne'er sweru'd.
FATHER ruin'd, the SON slighted,
And from the CROWN ne'er requited,
Lofs of ESTATE, RELATIONS, BLOOD,
Was too well known but did no good.
With long CAMPAIGNS and paines o' th' GOVT
He cou'd no longer hold it out.
Always a reftlefs life he led,
Never at quiet till quite dead.
He marry'd in his latter dayes
ONE who exceeds the common praise ;
But wanting breath still to make known
Her true AFFECTION and his OWN,
Death kindly came, all wants supply'd,
By giving REST which life deny'd.

An illustration of this brass is given in Poole's Antiq. of Coventry, p. 140.

In addition to these there are several other inscriptions on brass plates, the most noteworthy being :—

" Here lyeth Mr. Thomas Bond, Draper, sometime mayor of this cittie, and founder of the hospitall of Bablake, who gave divers lands and tenements for the maintenance of ten poore men so long as the world shall endure, and a woman to looke to them, with many other good gifts; and died the xviii. day of March in the year of our Lord God MDVI." Lisle Cave, Esq., 1622. Mrs. Mary Vavasour, 1631. John Wightwick, of Pembroke Coll., Oxford, 1637 ; fourteen Latin elegiacs, with punning allusion to the Holy Trinity; Abraham Astley, M.D., 1662 ; a Greek motto and twelve Latin elegiacs. The Honble. Caroline Hood, 1858.

Poole quotes the following from Sir John Harrington (temp. James I) :—" The pavement of Coventry Church is almost all tombstones, and some very ancient ; but there came in a zealous fellow with a counterfeit commission, that for avoiding superstition, hath not left one pennyworth nor penny-breadth of brass upon all the tombs of all the inscriptions, which had been many and costly." (Poole, p. 141.)

Holy Trinity Church. *John Whithead, mayor, and ws., circ.* 1600. *Haines.*

This brass is wrongly assigned by Haines to S. Michael's. It is 2ft. 4½in. by 18in., and is inlaid in a mural tablet with moulded border. The mayor wears a ruff and his official fur-edged gown. His hair is brushed back from the forehead,

and he wears a moustache and pointed beard. At the ends of a prayer-desk, before which he stands, kneel his wives. The one upon his right hand wears a high-crowned hat with narrow curled brim, over a "Paris head;" a ruff, an outer gown open down the front and confined by a sash, and an under dress. The wife on the left side is similarly dressed, but without the hat. Her French hood is depressed in the centre.

Below the former wife kneel three girls and a boy; under the latter, three boys and two girls, a prayer-desk separating the groups. The girls are dressed like the lady last described; the boys wear short doublets, knee-breeches, hose, and shoes. At the mayor's right hand are the arms of Coventry, at his left those of Whithead.

There is the following somewhat fanciful inscription:—

CARMEN IN OBITVM VIRI CHARISSIMI JOHANNIS WHITHEAD QUONDĀ PRAETORIS HUIUS CIVITATIS DIGNISSIMI.

ROMA NVMĀ JACTAT DECORAT LACEDAEMONA PRISCĀ
JVSTA THERAPNAEVS JVRA LYCVRGVS AGENS.
NON MINOR EST NOBIS PRAECISO STAMINE VITAE,
QVI JACET HIC CLAVSVS LVMINE CASSVS HVMO.
VIRTVTIS CVRSV CONSTANS ATHLETA JEHOVAE,
O QVAM LONGE ABERAT SVBDOLA GRAECA FIDES.
MORTVVS ANTE DIEM PROH, SAEVO FVNERE RAPTVS
TEMPORE PRAETVRAE, MORTVVS ANTE DIEM.
TEMPORE PRAETVRAE, TRIBVS ET PLUS PARTIBVS ANNI
OFFICIO FVNCTVS, SCANDIT IN ASTRA POLI.

In English thus:—Epitaph upon the death of the well-beloved John Whithead, sometime most worshipful mayor of this city.

Rome boasts of Numa: ancient Sparta's famed
For equal laws by her Lycurgus framed.
As great our chief who, in death's gloom profound,
His life-thread snapt, here rests beneath the ground.
God's steadfast champion in virtue's race,
No subtle Grecian guile might him disgrace.
Ere his day, dead, to cruel fate a prey,
He died in harness, ah! died ere his day.
He died in harness, scarce a year was given
In which to rule, ere he was called to heaven.

For an illustration of this brass see Poole, p. 140.

Mention should here be made of an ancient brass tablet, dated 1568, now in St. Mary's Hall, on which are engraved the conditions of the lease of Cheylesmore Park, granted by the Duke of Northumberland to the Mayor, Bailiffs, and Commonalty of Coventry.

(*To be continued.*)

FUNGUS-HUNTING IN SPRING.

BY W. B. GROVE, B.A.

Away to the woods! Away! The Spring is come. The longest, dreariest Winter of our time is gone; *abiit, evasit, erupit*, and, as our Warwickshire folk express it, "Joy go with him;" though why Joy should be expected to go with a guest whose departure is welcome I confess I never could understand. I would prefer she stay, and truly while fungi abound so thickly as they do, and eyes and microscope hold out to view them, there is little doubt she will.

It seems but a fortnight since we wandered disconsolate by icebound brooks and dreary hedgerows, and now on this brilliant day in early April the sun is shining in an almost cloudless sky, and the wind is scarcely chill. The hawthorns are leaping into leaf, the horse-chestnuts are bursting their huge buds, the catkins are hanging from the hazel, the flower-buds of the elm have decked each twig with two geometrical rows of rich brown globes.

In our sad brumal climate it is remarkable how speedy a change clear skies and the sun's unfettered rays work in us. Our blood courses quicker in our veins. Old and staid as we are, we vault the stiles and fences with a lively glee. But stay; as we place our hands for this purpose on a pole which forms the upper rail of a fence our eyes are attracted by a myriad black round tiny specks bursting through the bark which had not been removed from the rail. Behold a fungus.

"Thanks, thanks to thee, my worthy friend," thou unknown farming man, unwitting benefactor of thy kind, whose hand hath placed this pole to rot and grow rich in saprophytic life. A blessing in corduroy art thou to the mycologist; for the sticks thou plantest in the earth to make thy sham hedges, the chips and cuttings thou leavest in the woods and ditches, the stumps and logs thou lettest decay in winter instead of burning them to warm thy shivering limbs —all these are his happy hunting grounds, and of the smaller fungi yield him richest treasures.

Glancing again at the pole, our first thought is to determine the species of tree to which it belongs. This gives us pause. The pole is straight, about 8ft. long, and 5in. thick at the lower end; the bark is smooth, shining, and greyish, here and there brownish-white. It cannot be birch, for it is not white enough; nor beech, for it is too shining. The wood is not the pure white of the holly. The

bark resembles that of young hawthorn, and has in parts somewhat of the rich tawny sheen of the hazel; but the pole is too large for these. It has not the purple undertone of the laburnum, and the trunk is too straight; for the laburnum loves to grow in undulating curves, wherefore when young it lends itself readily (note this, ye suburban gardeners) to the tying of fantastic knots and loops, which in their old age will be a sight curious to behold. The wood shows that it is not young oak, though the bark is similar to that of a sapling "monarch of the forest." At last, I have it. It is a mountain ash!

Of course I am merely putting into words the thoughts which passed swiftly through my mind, while gazing at the pole. Further comparison and the judgment of a friend "weel acquent wi' trees" confirmed my conclusion; but a more decisive, because impartial, confirmation was still to come. Examined at home, the black specks of our prize resolve themselves into irregular globes, called perithecia, whose interior is filled with colourless spindle-shaped spores. This, combined with the habitat on the branch of a tree, shows that we must look for our fungus among the species of the genus Rhabdospora.

The first step towards its nearer determination was to make out the form and size of the perithecia, and here an unexpected difficulty presented itself; no two perithecia were alike; some round, some oblong; at one time single, at another crowded; now obtuse at the summit, now acute; here opening by a small round pore, there splitting with a long and gaping slit. These are the very points which we find in general to be helps in determining a species, but here everything is irregular. Then I look at the spores (or sporules), which by careful measurement are found to be about sixteen or seventeen thousandths of a millimetre long.

It remains but to turn to that monument of Herculean labour, the "Sylloge Fungorum Omnium" of Professor Saccardo. This great Italian mycologist, the professor of botany at the University of Padua, who stands head and shoulders above all the other mycologists of the age, has conferred upon his fellow-students a boon for which they can never be too thankful. In his Sylloge, he is collecting (for the work is not yet half finished) the descriptions of all known fungi, and our fungus fortunately belongs to one of the groups of which he has already treated. The perithecia, enclosing free spores, point it out as belonging to the Sphæropsideæ, a distinct and well-marked class which is swallowed up, under the old Friesian system, by that *olla podrida*, the Coniomycetes.

In the genus Rhabdospora, Saccardo enumerates only eighty-six species, and in a rapid glance down the pages the attention is at once arrested by *Rhabdospora inæqualis*, a name that seems exactly suited to describe the varying forms of the perithecia which were so puzzling. On looking below we find, in fact, that this very variation is given as characteristic of the species. The size of the spores is the same, the other points of the description are not inconsistent, and, most conclusive of all, the habitat is given as "on smooth bark of *Sorbus aucuparia*."

But we have not quite exhausted the resources of civilisation. This species was erected by Professor Saccardo himself in his "Reliquiæ Libertianæ," *i.e.*, the descriptions of part of the vast collection of fungi left behind by the late famous mycologistess (excuse the word) of Malmédy, the indefatigable Madame Libert. Now it is well known that Saccardo, with that care and perfection of method which have raised him to his present fame, generally illustrates by figures the new species which he describes, and, on turning to the part (Series iv.) of the Reliquiæ in which this species is contained, we find a figure which to our great delight proves to be an excellent representation of the one we have been examining.

"Now my task is smoothly done." No link in the chain is wanting. We have determined our fungus with a degree of certainty which cannot always be attained, and are still further rewarded by finding that it is a species new to Britain. Nor was this the only spoil brought back from that first spring walk, but time would fail to tell of all the others.

ON THE WEAPONS OF ANIMALS.*

BY F. T. MOTT, F.R.G.S.

In the vegetable world the struggle for existence is carried on not by active warfare but by the process of starving out. It is not a question of weapons but of vegetative vigour. In the animal world, however, with the capacity for locomotion comes war in its most violent and terrible aspects, and the provision of weapons for both offence and defence becomes one of the prime necessities of life.

* Transactions of Section D of the Leicester Literary and Philosophical Society. Read February 18th, 1885.

Plants as a rule do not feed upon one another, and obtain only an indirect advantage by the smothering of their competitors. But while one half of the animal kingdom feeds upon plants, the other half devours the flesh which is thus manufactured. The struggle for life is therefore much more complex, depending partly upon vegetative vigour, partly upon muscular development, but largely also upon the excellence of the weapons, and upon intellectual cunning.

The weapons are furnished either by the adaptation of various organs, or by the growth of additional organs for that especial purpose, and there is an extraordinary variety both in their structure and their uses. There is scarcely a single external organ which has not, in some species of animal, been adapted as a weapon of war. Teeth, tongue, lips, nose, eyes, ears, arms, legs, hands, feet, tail, hair, skin, and even the body itself are all made available as fighting weapons, besides a number of special growths taking the forms of horns, spurs, spines, tentacles, stings, javelins, stink-bags, and electric batteries.

Carnivorous habits are almost necessarily associated with fighting weapons, and as there are carnivorous species in every great division of the animal world, there are found in every one also organs of attack and defence, from the infusoria to the highest vertebrates.

The following table shows the various organs and special growths, with indications of the families and species by which they are used as weapons:—

MODIFIED ORGANS.

Teeth	Most mammals, reptiles, and fishes, and some invertebrates.
Tongue	Ant-eater, chameleon, frog, echidna.
Mandibles	Birds, tortoises, insects.
Palpi	Scorpion, chelifer.
Nose	Elephant.
Eyes	Snakes, for fascination.
Ears	Horse and donkey, as fly-flaps.
Claws	Carnivorous mammals and birds.
Hoofs	Ungulate mammals, for striking and trampling.
Fore limbs	Deer, swan and other large birds, for striking. Lobster, and other crustaceans.
Hind limbs	Horse, donkey, giraffe, cattle, &c., for kicking.
Tail	Whale, kangaroo, crocodile, and most land mammals, for defence.

Hair, as spines......	Hedgehog, porcupine, echidna.
Tentacles............	Octopus, hydra.
Body..................	Boas and pythons.
Skin..................	Toads and medusæ, by poison glands.
Voice.................	Many mammals, for paralysing by fear.
SPECIAL GROWTHS.	
Horns.................	Ruminant mammals, rhinoceros.
Spurs.................	Gallinaceous and some other birds. Ornithorhyncus.
Stings................	Hymenopterous insects, scorpions.
Poison fangs.........	Snakes, spiders.
Javelin hairs.........	Hydra.
Electric apparatus..	Torpedo, electric eels.
Stink-bag............	Skunk, bombardier beetle.
Ink-bag..............	Sepia.

To these natural weapons the apes and monkeys add the artificial ones of sticks, stones, and hard fruit, and in man the natural weapons are altogether subordinate, his higher intelligence enabling him to manufacture his fighting implements, thereby releasing all his natural organs for the multitudinous offices which he requires them to serve.

From the foregoing table several curious facts may be deduced.

It appears that the use of poison as a weapon is confined to the lower orders of animals. No creature higher than a reptile possesses poison glands of any kind.

Stings are confined to the invertebrates; and among insects to the hymenoptera, the ants, bees, and wasps, which for intelligence and capacity stand at the head of the insect world. The sting of the scorpion is rather an abdominal fang than a true sting, having some resemblance to the fangs of spiders, with which family the scorpion is nearly allied.

Horns and antlers in all their wonderful variety are developed only by the ruminant mammals, with the one peculiar exception of the rhinoceros. Horns which are hollow but permanent are characteristic of all cattle, sheep, goats, and antelopes; while antlers, which are solid but deciduous, being shed and reproduced annually, are peculiar to the deer family.

Probably there is some connection between the growth of horns in these ruminants and the fact that as feeders upon grass chiefly they graze with their heads close to the ground, so that weapons on the forehead are ready for instant use.

But the horse, donkey, and zebra are also grazing animals, yet they have no horns.

The most formidably armed of all animals are the cats. No weapon can be more powerful or terrific in its action at close quarters than the retractile claw wielded by such muscular limbs as those of the lion and the tiger, and when to this terrible claw is added the no less terrible canine tooth, the creature so armed may well become the tyrant of his jungle.

Perhaps the most remarkable of all animal weapons is the electric battery possessed by two families of fishes—the torpedoes and the electric eels. These batteries consist of plates of bone and cartilage arranged in a sort of honey-comb fashion, the interstices being filled with gelatinous liquid and the whole apparatus supplied with innumerable nerves. The torpedoes are flat fish, and have two batteries, one on each side of the head. The electric eels have each four batteries. That these are reservoirs of energy is proved by the fact that when exhausted by repeated discharges they only become recharged after long rest and an abundant supply of food. They afford strong evidence that nerve force is a form of the same energy which is exhibited in the physical world as heat, light, and motion.

Throughout the whole vertebrate section of the animal world *teeth* form one of the principal weapons, except among the birds. No bird has yet been seen with anything like true teeth. Birds form a highly specialised and almost abnormal class, evidently evolved by long selection from some old reptilian type ; and in the chelonian or tortoise group of modern reptiles occurs the same suppression of teeth and hardening of the lips into horny mandibles, which is so strongly characteristic of birds. The reason for this modification of the mouth in birds may, perhaps, be found in the same necessity for diminished weight which has modified their bones and limbs. The arched hook of the eagle's beak is as strong, though composed only of light horn, as any tooth could be of solid and heavy ivory. In the birds of prey there is the same combination of armed feet and mouth as in the mammalian cats. The talons of the eagle are not actually retractile, but the action of the free-spreading toes gives them a similarly piercing grip.

A considerable number of the weapons enumerated in the table are of rare occurrence, confined to small groups or single genera.

The palpi of the invertebrate mouth, which in most cases are soft and harmless organs, are converted, in the scorpions and chelifers, into weapons armed with jointed claws, like those of the lobster.

The nose becomes a formidable weapon only in the elephants.

The eyes can scarcely be reckoned among weapons at all, unless it be true that some snakes fascinate and paralyse their victims by their glassy and unwinking stare.

The ears of the horse, donkey, and some other animals are defensive only; but they are truly defensive weapons against the attacks of the gadfly and the tse-tse.

The use of a stink-bag, ejecting a pungent and disgusting liquid against pursuing enemies, is confined apparently to the skunk among mammals, and to two or three beetles among insects; and the ink-bag, rendering the water opaque so as to conceal the line of escape, to a few cephalopodous mollusks.

Nothing perhaps more distinctly marks off the human race from all lower animals than the entire absence of natural weapons. Man, inhabiting every region of the globe, is exposed to the attacks of every carnivorous beast and every poisonous insect; and he captures and eats a greater variety of prey than any other creature, yet he is naturally unarmed and defenceless. Brain power manifests in him its infinite superiority to brute force, and its development continually widens the gulf between him and his ancient ancestry, and opens to him the gateway of a new life.

THE PRINCIPLES OF BIOLOGY.*

BY HERBERT SPENCER.

Exposition of Chapters VIII., IX., X., "The Evolution of Life."

BY W. H. FRANCE.

"How is Organic Evolution Caused?"

The title of this chapter is a question which the chapter itself does not attempt to answer, except in a negative sense, and that only to a very limited extent; but sufficiently so to show that to further pursue the subject on such lines would be a waste of time and thought. To minds free from bias, principles which are erroneous soon show themselves as such, and, when recognised, the sooner they are abandoned the better.

* Transactions of the Birmingham Natural History and Microscopical Society.

Mr. Spencer has, in the chapter now under notice, referred to attempts on the part of De Maillet and others, including Dr. Erasmus Darwin (father of Charles Darwin), and also Lamarck, to explain organic evolution by the assumption that each form of life is imbued with an inherent disposition to develop new and improve existing organs, with also the tendency to transmit to their progeny such organs more or less developed, with increased desires for greater complexity of organisation.

Now, without any desire to ignore the facts of hereditary transmission of organs, whether rudimentary, developed, or even potential, it is only necessary to bear in mind the infinite variety of forms of life to perceive at once that such influences are but factors in the problem, and important as they undoubtedly are, they are quite insufficient for our acceptance as an explanation of the resultant effects. Where the conditions of life are stationary, forms of life are stationary also. Progress in organic development, either of kind or function, is not essential to vitality.

There are many kinds of plants and animals which, under existing conditions, are doomed to that extinction which, in every direction, has overtaken forms of life which, like individual lives, can never reappear, but under the improbable, if not impossible, recurrence of exactly the same conditions under which they were developed and maintained. I have yet to learn that individual lives of apparently expiring forms of life show any decadence of vitality. The facilities for the extension of any form of life over a larger area, or an increase of numbers on a given area, may be increased or lessened without any consequent individual loss of vitality, such as would be indicated by shortened lives. There is a plant, well known to us all by the name of groundsel—I abstain from the use of botanical terms as I am too ignorant to inflict them upon you—which, because it gives us trouble, we call a weed; and which I believe is doomed to extinction on account of its propensity to fertilise itself with its own pollen. However much that propensity may hasten the time when from its rarity the said plant may, for its beauty, be deemed a flower and treated as such, individual plants flourish without any apparent or recorded diminution of vitality.

The florist takes in hand an insignificant plant, and by skilful manipulation produces from it endless varieties of form and colour, none of which would have been produced but for the florist.

By similar processes of selection, the flockmaster suppresses in the sheep that of which he disapproves, and developes that which he desires as dictated by fashion or requirement.

Subjected as every department of nature now is to the scrutiny of modern science, the fact of universal evolution could not much longer have remained undiscovered.

Voltaire was once by all—and still is by some—theologians charged with atheism. Yet it was he who wisely asserted that were there no Creator, it would be necessary—in order to account for facts around us—"to invent one!"

In the same way, had we not in our vocabulary a word of sufficient expansiveness to cover the universe of mind as well as of matter, we should have to invent one. But as men's minds, searching after truth, saw in every direction, not only in existing, but in geologic records of successive forms of life, change without disruption, it became more and more necessary to frame a formula which should express the order which reigns where previously it was thought that accident and chaos might be held accountable for all that happened.

Thus the word "Evolution" has been raised to a dignity rivalling that of "Creator" in its universality. The application of the word "evolution" is, even by many students, limited to only a part of its full significance. An organ, by disuse, first loses its function, then the organ itself will in part or entirely disappear, according to its value in the general economy of the life of the animal or plant of which it forms a part. The partial or entire suppression of organs no longer required, or which are less necessary than previously, is clearly as much a part of evolution as is the development of entirely new organs either in substitution for or addition to existing organs. Further, what we call degradation even to extinction is still evolution. Death itself is necessary for the maintenance of life. So then the theory that high and complex forms of life are due to an innate desire on the part of low and simple forms to attain to something higher and more complex as presumably better is in no way substantiated by facts. Under prolonged domestication animals lose simultaneously or successively those organs which in a state of perfect freedom and self-dependence are necessary for attack or defence against other animals or climatic rigour.

The Shetland ponies wear more shaggy coats on their home hills than in this and other milder climes to which they are transported. Those animals which are reared in variable climates change their natural covering to suit the changed external temperature. So also do plants. The sheep in a wild state grows horns for combative purposes and conditions which do not exist under domestication. The hair-like wool of the wild sheep is better adapted to keep its body uniformly dry than is the absorptive covering which has been developed

by agricultural selection and treatment. Coarse hair-like wool and horns are both objected to by the careful flock-master, who is constantly striving to suppress the tendency to reversion to those and other features prominent in wild sheep, and even in those which are in a semi-wild state on our mountains. I therefore suggest as an answer to the question conveyed in this chapter, that organs are produced or suppressed, not by an inherent tendency to produce or suppress, but solely by a prolonged and increasing necessity for such changes, such necessity being caused by modifications of environment due to climatic variations, which again are caused partly by terrestrial disturbance but mainly by changes in the form of our path round the sun.

The foregoing remarks are intended to refer to Chapters VIII., IX., and X., but were intentionally written before reading the two last mentioned, for the reason that I preferred thinking out for myself an answer to the first to acting simply as an echo, even to Mr. Herbert Spencer. By reading to you a few extracts from Chapters IX. and X. you will be well able to decide to what extent, in dealing with the question propounded in Chapter VIII., I have taken lines of thought parallel to those of Mr. Spencer.

DR. T. SPENCER COBBOLD, F.R.S., F.L.S.

It is with sincere regret we record that this distinguished Naturalist and Helminthologist passed over to the great majority on Saturday, the 20th of March last, at the comparatively early age of 58. Dr. Cobbold came of an old Suffolk family, his father being the Rev. Richard Cobbold, of Wortham, in that county, who was possessed of considerable literary ability. Dr. Cobbold was born in the year 1828, and was educated at the Charterhouse in London. After serving a three years' apprenticeship with Mr. Crosse, an eminent surgeon of Norwich, he proceeded, in 1847, to the University of Edinburgh, where he matriculated. His early talent was soon recognised, even as a student, in dissecting, in the preparation of specimens, and also as a draughtsman, and he was honoured by Professor John Goodsir with the appointment of Prosector. Under the influence of this great anatomist, and of the genial and accomplished Professor Edward Forbes, it was only natural that he should be attracted from his profession of medicine to the more absorbing study of animal morphology, and he soon after received a gold medal from the Medical Faculty for an essay

in original research, on the "Canal of Petit." Many important papers followed, notably one "On the Anatomy of *Actinia*," in the Annals of Natural History for February, 1853, and the article "Ruminantia" in the Cyclopædia of Anatomy and Physiology, 1856. Honours also rapidly succeeded; he became President of the Royal Medical Society, and Curator of the Anatomical Museum.

Dr. Cobbold left his *alma mater* in 1856, and removed to London, where he devoted himself to the then neglected and somewhat repulsive study of animal parasites. In this he soon became famous, and his *opus magnum* on "Entozoa," published in 1864, and its supplement in 1869, and subsequent writings will take rank with the great works of Van Beneden, Von Siebold, Kuchenmeister, and Leuchart. From a sanitary point of view it is scarcely possible to estimate the value of the researches of these distinguised Helminthologists, who have educated the people to an appreciation of their science in its practical bearing, and thus greatly added to human life and happiness.

Dr. Cobbold was elected F.R.S. in 1864, and he held several professorships in London; one of the most important being that of Swiney Professor of Geology, under the Trustees of the British Museum, and he had also been President of the Quekitt Microscopical Club.

His memory will be long held in respect, both by the Members of the Birmingham Natural History and Microscopical Society, and by the Members of the Midland Union. He was an honorary Vice-President of the Society, and he was among the early founders of the Union, in both of which he took great interest. His long and valuable series of Papers on the "Parasites of Man," which appeared in the early numbers of the "Midland Naturalist," have been again and again recognised not only in England, but also on the Continent, and in America.

In private life Dr. Cobbold had many attractions irrespective of his scientific abilities. His brightness and trueheartedness, his desire for others rather than himself, his intellectual companionship, and his ready willingness whenever his services were sought in the offices of friendship, are qualities that ennoble the man beyond even his fame as a scientist.

Dr. Cobbold succumbed after a few hours' illness from a long-standing cardiac affection, in perfect consciousness and thoughtfulness, and he leaves a widow and several sons and daughters to mourn his loss. His place in the science that he followed cannot readily be filled. W. R. H.

FAULTS IN THE DRIFT.

BY W. J. HARRISON.

At Kibworth, about eight miles south-east of Leicester, I examined some extensive sand pits in 1875. The sand and gravel is false-bedded, very flinty, with the black streaks which seem everywhere to characterise these drift-sands. The gravel is worked to a depth of from 30 to 40 feet, below which the presence of water stops the working. In some of the pits the sand is distinctly faulted, the faults being of small throw, not exceeding a few feet. The existence of faults in the drift has been strongly denied, yet here the beds are undoubtedly displaced. I do not, however, think that the faulting extends to the lias beneath. Probably it is due to a "settling" of the sands, owing to some change at their base. In the pit which lies 200 yards north-east of the railway station the lower part shows some remarkable contortions; a bed of clay, which looks like reconstructed lias, being pushed up into long tongues, which penetrate the gravel. A block of lias limestone here, full of *Cyryphæa incurva*, had one side as finely polished as could have been done by hand. We have here unmistakable evidence of the presence of ice, either as a berg or a glacier. The surface of these pits is about 376 feet above sea level. From one of these pits a workman gave me some fragments of encrinite stems—"sharks' backbones" he called them.

ANNUAL MEETING OF THE MIDLAND UNION OF NATURAL HISTORY AND SCIENTIFIC SOCIETIES,

To be held at Shrewsbury, June 22nd and 23rd.

The Reception Rooms will be at the Music Hall in the Market Square, where also the Council Meeting, at 12 noon, and the General Meeting, at 3 p.m., will be held on Tuesday, June 22nd.

After the Meeting there will be a visit round the Churches and other objects of Antiquarian interest of the town.

The Conversazione will be held at the Music Hall at 7.30. Members of the Associated Societies willing to contribute specimens and objects of interest for the Conversazione will kindly communicate with W. Phillips, Esq., 37, High Street, Shrewsbury.

On the 23rd of June there will be Three Excursions, of which the objects will be mainly Geological, Botanical, and Archæological respectively.

GEOLOGICAL EXCURSION.

The party will leave Shrewsbury by the 10.35 train for Craven Arms Station. On their arrival they will proceed along the Corvedale Road, passing on their way quarries of Aymestry Limestone, to Norton Farm House, where a good exposure of the famous Ludlow Bone Bed may be seen, as well as sections of the Upper Ludlow and Downton Sandstone containing characteristic fossils. From Norton they will ascend to the edge of the Bluff, called Norton Camp, a good specimen of British or, in the opinion of some, of Saxon entrenchment. A fine and instructive view is afforded at various points of the route of the succession of strata up to the Carboniferous towards the East, and down to the Llandeilo on the West. From the Camp a descent may be made to Stokesay Castle, a fortified mansion of the age of Edward I., not far from which is a quarry replete with Lower Ludlow forms. The entire distance of the walk and back to the station is five miles.

A Meat Tea will be provided at the Craven Arms Hotel, close to the Station, at 5 P.M. The Return Train arrives at Shrewsbury at 7.35. The Excursion will be conducted by the Rev. J. D. La Touche, President of the Union, who will point out the various objects of interest from time to time along the route.

BOTANICAL EXCURSION.

The party will drive to Colemere Village and from thence walk by Colemere Mere and Kettlemere to Ellesmere. If time permit they will also visit Whitemere. A Meat Tea will be provided at Ellesmere, and the party will drive back to Shrewsbury in the evening.

ARCHÆOLOGICAL EXCURSION.

Carriages will take up the party in the Market Square at 9 30 A.M. The drive will be over the English Bridge, and by the Abbey Foregate, Lord Hill's Column and Atcham Bridge, to Wroxeter, where a halt will be made for the inspection of the "Old Wall" and other remains of the Ancient Roman city of Uriconium. The work of excavation has laid bare the foundations of walls, pillars and other remains of Hypocausts, tesselated pavements, &c., and some of these may still be seen. A large collection of objects of interest found during the work of excavation may be seen in the Museum of the Free Library, at Shrewsbury; and in Part III., Vol. II. of the Transactions of the Shropshire Archæological and Natural History Society is an article on "Roman Shropshire," by Mr. W. T. Watkin, in which much interesting information relating to Uriconium is given. The church at Wroxeter will be next visited. The tombs of the Newports in the interior are worthy of an inspection. From Wroxeter the drive will be continued, leaving Eaton Constantine on the left, through Leighton to Buildwas, where time will be given for a visit to the finely situated ruins of the Abbey. Hence a short drive will bring the party to Much Wenlock, where the ruins of the Priory, the Church, and other objects of interest will be visited. After a Meat Tea, at 4.30, the return drive to Shrewsbury will be by Harley and Cressage, Shrewsbury being reached about 7 P.M. The scenery passed through in this drive is of great beauty.

The very attractive character both of the ancient town of Shrewsbury and of the surrounding country makes it probable that this Meeting of the Union will be of unusual interest. Three such Excursions could probably be offered by but few localities within the boundaries of the Midland Union, and the archæology of Shrewsbury itself will furnish abundant interest to those whose tastes lie more particularly in that direction.

It only remains for the Members to attend the Meeting in such numbers as to repay the labour that the Local Committee have given to make the Meeting a great success.

Review.

Synopsis of the Natural Orders of British Flowering Plants. By Joseph W. Oliver.—London: Simpkin, Marshall, and Co.

This very handy little book is compiled for the use of students preparing for the Science and Art and other examinations in Botany. It contains within the compass of eighteen pages the general characters of each British natural order of flowering plants; together with the number of genera and species found throughout the world, the number of genera and species found in Great Britain, and the scientific names of the leading British genera. To the overtaxed student it will be a great boon, giving him, in small space and at little cost, information only to be found in much more costly books. If the advice given by the compiler be strictly followed, the knowledge gained will be of the greatest service in the examinations. The arrangement is mainly that of Bentham's Handbook, and the diagnosis of the natural orders that given in the Student's Flora. The type is small but clear, and the book a very convenient size for the pocket. J.E.B.

METEOROLOGICAL NOTES.—March, 1886.

Pressure was unsteady till the 6th, when the mercury rose rapidly, reaching 30·500 inches, its highest point, on the 11th; thence it fluctuated downwards to the end of the month. The mean temperature was about one degree below the average. The first eighteen days were decidedly cold, the maximum being below forty degrees on eleven days. From the 18th to the end of the month more genial weather was experienced. The highest maxima were 64·9° at Loughborough and 64·0° at Henley-in-Arden on the 24th; 63·2° at Hodsock on the 21st; and 61·0° at Strelley and Coston Rectory on the 24th. In the rays of the sun, 126·6° at Hodsock on the 6th; 116·8° at Loughborough, and 107·2° at Strelley on the 25th. The lowest minima were 6·5° at Coston Rectory, 8·4° at Hodsock, 13·3° at Strelley, 13·5° at Henley-in-Arden, and 16·1° at Loughborough, all occurring on the 7th. The thermometer on the grass registered 5·4° below zero at Hodsock on the 7th, 10·5° at Strelley on the 6th, and 14·6° at Loughborough on the 7th. Rainfall was above the average, the total values of rain or melted snow being 3·15 inches at Strelley, 2·70 inches at Loughborough, 2·58 inches at Coston Rectory, 2·35 inches at Hodsock, and 2·21 inches at Henley-in-Arden. Heavy rain fell in some districts on the 30th, when 1·23 inches were collected at Strelley, and 0·82 inches at Loughborough. The number of "rainy days" varied from fourteen to twenty.

The amount and frequency of snow storms were unusual for March. A slight thunderstorm visited Loughborough on the 29th, and thunder was heard at Coston Rectory on the same day. Sunshine was deficient.

12, Victoria Street, Loughborough. WM. BERRIDGE, F. R. Met. Soc.

Natural History Notes.

COMPOSITION OF THE EARTH.—The following estimate of the proportion of the various elements in the crust of the globe is by the Italian geologist, Prof. A. Stoppani :—

	Parts in 1000
Oxygen	500
Silicon	250
Aluminium, Magnesium, Calcium, Potassium, Sodium, Iron	227
Carbon, Sulphur, Hydrogen, Chlorine, Nitrogen	23

Of the remaining elements, about 57 in number, the aggregate mass is too small to be noticeable.—H.

BOULDER-CLAYS.—The finely laminated clays which occur irregularly in the drift I have always found to be unfossiliferous. They appear to have been formed by rapid streams issuing from the termination of the melted ice and carrying along the finely-divided particles which are formed by the crushing of the rock-fragments along the bed of a glacier.—H.

TREES.—At the outside there are only about fifty common forest trees in Great Britain ; not more than twice as many as the letters of the alphabet. Yet how many know the alphabet of trees? How many people can name even the trees they see in a single walk? Loudon's book, now out of print, is still the best general guide to a knowledge of trees and shrubs.—H.

REPTILES — ROMAN COINS.—Will any reader of the "Midland Naturalist" kindly inform me if "Reptiles" exist at the present time in Ireland ; and, if so, what species, and in what localities? Also the best work from which to name and tabulate "Roman Coins," together with price and name of publisher.—J. W. BODGER, 18, Cowgate, Peterborough.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—GENERAL MEETING, March 2nd.—Dr. Crosskey delivered an address on "The Physical History of Great Britain from the Glacial Epoch to the Present Day." Dr. Crosskey chiefly occupied himself with the discrimination between the established facts and the problems yet to be solved. A rise in the level of the land accompanied the coming in of Arctic conditions. The exact height reached is uncertain, but the existence of large river beds beneath ice-made clays ; the changes in water courses necessary for the existence of

many caves; the evidently altered courses of some of our present rivers, prove the alteration of level. Which of our local Midland glacial beds, if any, belong to this period of extreme cold and elevation is a point to be examined. Was there a great ice sheet obliterating hills, valleys, and plains, or simply an Alpine condition of the country? Subsidence followed. What was its depth? Certainly 1,400ft., probably 2,000ft. The local shell only proves a depression of 500ft. or 600ft. Dr. Crosskey found marine foraminifera near Wolverhampton 519ft. above the sea level. Elevation and subsidence, however, must have gone on irregularly, and have been effected to a greater and less extent in various localities. The surface of the land did not go up *en masse* and sink down *en masse* in two consecutive movements without any break any more than the climate became colder and colder and then hotter and hotter without fluctuation. The evidence there is of these fluctuations was noted. In the *Archipelago* condition of what is now Great Britain icebergs must have floated in the seas. *Some* of our boulders must have been dropped as they melted. But the question remains open for study whether the great and extraordinary accumulations of boulders mark the trail of the land ice or could have been deposited by icebergs. The land on its re-elevation attained a slightly greater height than at present. The work of ice in the valleys during modified Arctic conditions has to be distinguished from the older ice work. During this period a slightly warmer climate prevailed in Great Britain and forests flourished at heights and in latitudes in which they cannot now grow. Among the evidences of local land ice Dr. Crosskey noted the distribution of the Charnwood Forest and also the Rowley Rag boulders.—General Meeting, March 30.—The President, Mr. R. W. Chase, in the chair. Mr. Charles Pumphrey exhibited the section of a log of macassar ebony, perforated, as he supposed, by pholas; also two shells, apparently marine. Mr. W. P. Marshall, M.I.C.E., then read his paper, entitled "Notes on a Tour in America," which will appear in a future number of the "Midland Naturalist."—General Meeting, April 6th.—The President (Mr. R. W. Chase) in the chair; nearly sixty members and friends being present. Mr. J. Edmonds read a paper, "Hints on Photo-micrography," which he illustrated by exhibiting a series of negatives and positives, which he had taken on glass from various microscopic specimens, including insects whole and portions of some more magnified; sections of plants, and a few sections of rocks. He then exhibited a photo of the apparatus he had used, and gave a lucid description of it, remarking, for the encouragement of beginners, that with the recent improvements the process was easy, and need not be at all expensive. Mr. C. Pumphrey showed the pictures by the aid of the oxyhydrogen lantern; and afterwards he exhibited a number of views he had taken, showing the very interesting manner in which the cliffs of Bournemouth are weatherworn. He then rapidly showed a series of photos he had taken of flowers (mostly Alpine), animals, and snow scenes taken during some of the recent snowstorms. Mr. Pumphrey afterwards threw upon the screen some photos taken by Mr. T. H. Waller, B.A., of various rock sections, and also some photos of diatoms, &c., taken by Mr. Iliff.—Microscopical General Meeting, April 20th, the President (Mr. R. W. Chase) in the chair.—The news was received with deep regret of the death of two eminent scientists, T. Spencer Cobbold, M.D., F.R.S., whose papers and specimens have frequently been sent to this Society, and of the Rev. W. W. Newbould, M.A., whose labours in the Botany of this district have rendered more complete Mr. Bagnall's Flora

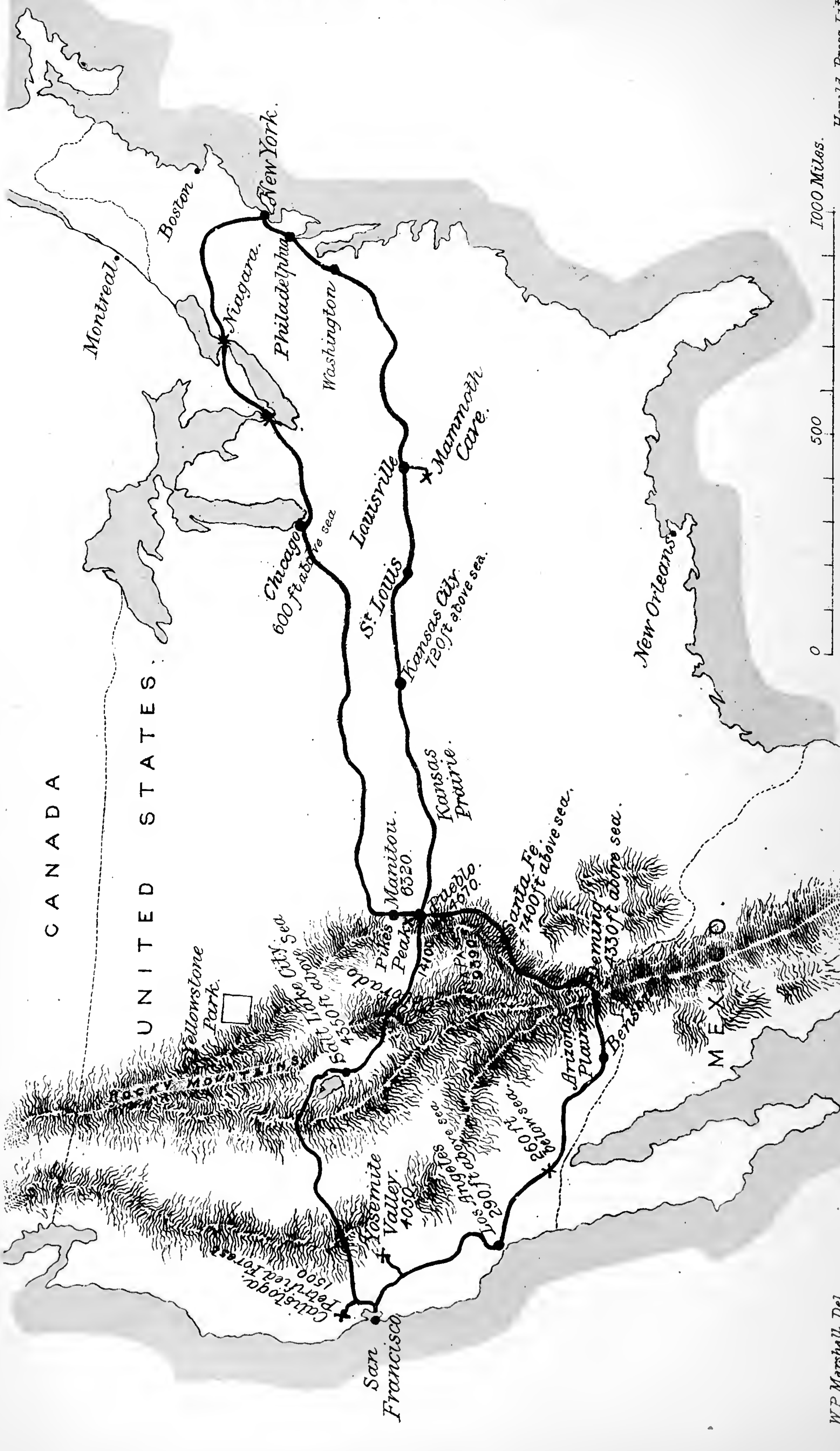
of Warwickshire. Mr. J. E. Bagnall, F.L.S., read an account of a visit to the Arrow district, and exhibited a series of mosses, lichens, and plants which he found there, including *Helleborus viridis* (Green Hellebore), *Dicranum fuscescens*, *Scleropodium illecebrum*, &c. Mr. W. B. Grove, B.A., exhibited sterile form of *Corticium sanguineum*, staining the wood scarlet, and green oak wood stained by the mycelium of an *Helotium;* also wood (? alder) stained orange by the sap. Mr. W. H. Wilkinson exhibited *Agaricus ostreatus*, the oyster fungus, from a poplar tree; an edible species. Mr. T. Bolton exhibited a small but interesting myriapod, *Polyxenus lagurus*, from King's Norton. Professor W. Hillhouse, M.A., then gave a minute description of the structure of a fern, and exhibited two living plants, *Osmunda palustris* and *O. regalis*, of which he showed sections to illustrate his remarks. After referring to the height to which the latter plant sometimes attains, 8ft. to 10ft., the Professor described the erect under-ground stem and its anatomy; then the leaf-stalk and the barren and spore-bearing leaves or fronds; and next described the curved lines of the vascular system, affording the most perfect mechanical arrangement for the requirements of the plant; and concluded by describing the alteration of the leaflet into the spore capsule, each nominally containing thirty-two spores. The beautiful sections under the microscopes, the diagrams, and the black-board sketches added very much to the interest of the lecture. After remarks by Messrs. Chase, Bagnall, Browett, and Morley, a hearty vote of thanks was passed to Professor Hillhouse.

BIRMINGHAM MICROSCOPISTS' AND NATURALISTS' UNION.—March 22nd. Mr. Hopkins exhibited specimens of Stag Beetle, *Lucanus cervus;* Mr. Corbet saurian remains from the Greensand, Cambridgeshire. Mr. Hopkins then read a paper on "A Day's Shell Collecting in Hampshire." The object of the journey was to procure specimens of *Helix obvoluta*, said to be found there. The paper described the visit as a successful one, the day's collecting yielding thirty-four species of land shells, including specimens of the one wished for. March 29th. Mr. Insley presented, on behalf of Mr. J. E. Bagnall, a number of diatomaceous earths from the United States. Mr. A. T. Evans exhibited a fossil coral from Ohio; Mr. Dunn, specimens of a fruit from India, the juice of which is used by the natives as a marking ink. Under the microscope Mr. J. Moore showed eggs of *Planorbis corneus;* Mr. Hawkes, a fungus, *Torula herbarum;* Mr. Tylar, sections of chalk, from Antrim, and pitchstone, from Arran.—April 5th. Mr. J. Madison exhibited specimens of *Actinocrinus* and *Productus punctata*, from Clitheroe; Mr. A. T. Evans, shark's teeth, from greensand; Mr. C. F. Beale, *Lima gigantea*, from Lower Lias, Barrow-on-Soar, and a group of *Gryphea incurva*, from Kilby Bridge; Mr. C. P. Neville, beetles, from Brazil; Mr. Mulliss, larva of gadfly, *Tabanus autumnalis*. A paper was then read by Mr. H. Insley on "The Past and Future of Geology." The writer stated that Geology, as a science, had not a history of great antiquity, though ideas regarding the origin of the earth were probably as old as mankind. The rise and progress of the science from early times was traced, and the work done by ardent enquirers summed up. A brief resumé of the effect of geological thought upon current Theology brought the paper to a close.—April 12th. Mr. J. Madison exhibited *Planorbis corneus*, densely clothed with an alga; Mr. Moore, specimens of *Unio tumidus* and *U. pictorum*. Under the microscope Mr. J. W. Neville showed the antenna comb of honey bee.

LEICESTER LITERARY AND PHILOSOPHICAL SOCIETY. —SECTION D, ZOOLOGY AND BOTANY. Chairman, F. T. Mott, F.R.G.S. Monthly Meeting, Wednesday, April 21st. Attendance twelve (two ladies). The Chairman read the draft of the annual report of the Section to be presented to the Council of the Society, which was approved and adopted. Exhibits :—A leaf of chrysanthemum on the under-side of which were several minute cocoons of some very small insect, by Mr. E. F. Cooper, F.L.S. Mr. Vice undertook to keep these cocoons and report the nature of the insect which should emerge. Specimens of *Ricciocarpus natans*, a floating hepatic new to the county, recently discovered in a pond near Thurcaston, by the Chairman. Dr. Finch read a paper on *Colchicum autumnale*, commonly called the autumn crocus, which abounds in a meadow near Keyham, and has the unusual habit of producing its leaves in spring, its seed-vessels in summer, and its flowers in the autumn. The seed-vessels are of course those which result from the flowers of the previous year, but it was believed by early writers to be an anomalous plant which produced its seeds before its flowers. The poisonous and medical properties of the several parts of the plant were pointed out, and the paper was illustrated by an excellent series of fresh and dried specimens, in various stages of growth. Mr. Thos. Carter, LL.B., read a letter from Mr. L. Fosbrooke, jun., of Ravenstone, describing the recent capture of a badger in that neighbourhood.

PETERBOROUGH NATURAL HISTORY, SCIENTIFIC, AND ARCHÆOLOGICAL SOCIETY.—March 18th. GEOLOGICAL SECTION. —Chairman, Mr. E. Wheeler. The subjects considered were the Danish peat and shell mounds, Crannoges and the lake dwellings of Switzerland.—March 25th. BOTANICAL SECTION.—Chairman, Mr. J. W. Bodger. An informal address was given by the chairman on the plants brought by the members, viz.: *Draba verna*, *Tussilago farfara*, *Lamium purpureum* and *L. album*, *Mercurialis perennis*, *Arum maculatum*, *Senecio vulgaris*, *Capsella Bursa-pastoris*, *Ranunculus Ficaria*, *Viola odorata*, *Stellaria media*, *Cerastium semidecandrum*, *Corylus Avellana* (showing both male and female flowers), and *Bellis perennis*. The various forms of leaves and parts of the flowers were considered, and the chief characteristics of the plants pointed out.—April 2nd. GEOLOGICAL SECTION.—Chairman, Mr. E. Wheeler. Subject considered: "The Alluvial Deposits of the Palæolithic Age."—April 8th. BOTANICAL SECTION.—The chairman gave an address on "Phyllotaxis, or the Arrangement of the Leaves," illustrating the terms orthostichy, cycle, and genetic spiral by means of diagrams; showing also plants of *N. O. Labiatæ* and *Caryophyllaceæ* having a divergence of $\frac{1}{2}$, also Sedges with $\frac{1}{3}$ divergence, and giving instances of divergences of $\frac{2}{5}$, $\frac{3}{8}$, $\frac{5}{13}$, $\frac{8}{21}$, and $\frac{13}{24}$. Miss Lilley exhibited in flower *Lamium album*, *Cerastium viscosum*, *Cardamine hirsuta*, *Corydalis solida*, *Capsella Bursa-pastoris*, *Narcissus Pseudo-narcissus*, and other plants.—April 15th. GEOLOGICAL SECTION.—Chairman, Mr. E. Wheeler. Portions of Lyell's "Students' Elements," pages 126—143, were read and discussed, reference being made by Mr. J. W. Bodger to the skull of the ox found in the Cambridgeshire Fens with a flint celt partially imbedded in the bone immediately between the horns; and by whom bones and teeth of *Elephas primigenius*, *Equus caballus*, *Cervus alces*, and of other animals from the Pleistocene gravels in the neighbourhood of Peterborough were exhibited.

AMERICAN TOUR.



Herald Press. Lith.

W.P. Marshall. Del.

NOTES OF AN AMERICAN TOUR.*

BY W. P. MARSHALL, M.I.C.E.

In this tour, which was taken last spring, the special objects aimed at were to see the great Yosemite Valley in California, within 150 miles of the Pacific Coast; the Pike's Peak District of the Rocky Mountains in Colorado; the Mammoth Cave of Kentucky; and to visit again the wonderful Niagara Falls that I had seen the year before on the occasion of the British Association Meeting at Montreal in Canada. The route taken extended across the continent, from New York to San Francisco, going on the way down to the Mexican frontier in the South, and returning by a different route up to the Canadian frontier in the North on the way to New York, as shown on the map, plate II.

The time of this trip was the two months of May and June, and that time of the year seems specially favourable for a visit to the North American continent, being clear of the winter snows, with the advantage of the recently melted snow for filling the waterfalls, and also clear of the great heat of summer, which is very oppressive in the greater portion of the continent, going up to a temperature of 100 degrees and upwards in New York. That city is in the same latitude as Naples, about 40 degrees latitude; and the most southern point visited on the Mexican frontier is in the same latitude as Alexandria in Egypt. The northern boundary between the United States and Canada is in the latitude of Paris, and the dotted line of 50 degrees latitude shown through the southern portion of Canada is the same as the south of Devonshire.

The most striking feature that claimed notice was the immense size of the country, which is nearly as far across from New York to San Francisco as the whole length of the voyage from England to New York (each about 3,000 miles), and on arriving at San Francisco you find yourself one-third way round the world, and your watch has to be altered eight hours from English time, or one-third of the whole twenty-four hours.

On the return to New York, at the end of this American tour, I found that I had travelled more than 8,000 miles without going out of the United States or going over any of the ground

* Transactions of the Birmingham Natural History and Microscopical Society. Read March 30th, 1886.

twice; and this distance is equal to the diameter of the earth, so that if there had been a passage through the centre of the earth to the other side that would not have been a longer journey. A most striking impression was received of the vast extent of the United States, which are seen to be really a compound of many widely different countries—the older Eastern States each about the size of England on the average, and the newer Western States several times larger. The contrast is very striking in going from New York State, with its energetic restless Yankee activity, to Virginian take-it-easy indolence of habit; and the contrast in the scenery from the extensive wooded hills and valleys of New York and Vermont to the barren prairies and wild deserts of Kansas and Arizona. The changes in the people too are very marked in going West, where they speak like English without the peculiar Yankee twang of the Eastern States; which is probably simply a survival of the old Puritan style of speaking established by the first settlers, the Puritan Fathers, and has since become greatly mixed and diluted in the Western States by the enormous subsequent immigrations.

New York is pre-eminently the capital of the United States, as London is of Great Britain; being equal in population to the whole of the ten next largest cities of the country, and as large as one-half the population of London, including with New York, Brooklyn and New Jersey, which are on the opposite banks of the two rivers.

New York itself is in a very unique position, and occupies the whole of an island ten miles in length and two miles in width, with the great Hudson River on one side, and on the other side the narrow extremity of the arm of the sea that separates Long Island from the main land. Brooklyn is situated on Long Island, and is as large as one-third the size of New York; New Jersey is on the main land, one-quarter the size of Brooklyn. The island on which New York stands, called Manhattan Island, is filled up completely with houses, excepting a small portion at the North end that is not yet built upon, and excepting the large Central Park that is reserved in the centre, about two and a-half miles in length and half a mile in width, which is beautifully laid out as ornamental pleasure grounds and forms a charming breathing place in the middle of the great city.

The streets are all at right angles and in straight lines, excepting the old portion of the city towards the southern point, which is irregularly built, and excepting the most important street, the celebrated "Broadway," which crosses the other streets obliquely for a great portion of its length.

The elevated railways are a special unique feature, and extend for eight miles in length from the southern extremity of the city; they are a very great convenience for quick and ready access to widely distant parts; fivepence (ten cents) fare anywhere by trains running every two or three minutes, with frequent stations.

The southern extremity of the city ending with Battery Point is the special business portion, containing the celebrated Wall Street great Stock Exchange and the wharfs from which the English steamers start. The approach from the sea is by the fine large harbour of New York, four miles wide, which is a remarkable sight with its throng of vessels of all kinds, including the numerous great ferry boats passing incessantly in all directions. The entrance to the harbour is at the outer bar of Sandy Hook, eighteen miles from New York, beyond which all the large steamers have to be piloted on departure and arrival, causing often a considerable delay; and the passage time of the steamers is consequently reckoned to and from Sandy Hook as a definite measure for the speed of passage. Some gigantic submarine blasting operations have been many years in progress for the removal of rock obstructions in the approach to New York from the opposite direction by the sea passage between Long Island and the main land, which will lead to the distance from England being shortened, and avoid the delay caused by Sandy Hook bar.

The railways to the North and East come into New York to the Central Station near Central Park; but those to the West and South, including by far the largest portion of the whole traffic, have to stop in New Jersey, on the opposite side of Hudson River, and the passengers are conveyed across to and from each train in very large ferry boats, which are like floating stations, and carry over horses and carriages with the passengers. As the river is too large for a bridge, a tunnel has been attempted for removing this great drawback, and bringing the railways direct into New York; but the work of the tunnel was stopped when only about one-quarter made, from the serious difficulties met with of sand beds under the river, and this work is still in abeyance. There is now, however, a bridge on the other side of the city over to Brooklyn, the celebrated Suspension Bridge, which has the largest span of any bridge yet constructed, and forms a very fine object in the view on approaching by the harbour.

Coney Island Elephant should be mentioned as a conspicuous object in the approach from sea to New York Harbour; it is a wooden seaside refreshment house, built in

the form of a gigantic elephant, 130ft. length in the body, and 170ft. height to the top of the howdah canopy. It is entered by a spiral staircase up one of the legs, and stands in a tea garden on the shore (a truly American notion).

We now start from New York for the far West in the Philadelphia express, the quickest train in America, running the ninety miles from New York to Philadelphia in two hours, with one stoppage; and although this may not appear at first any very special speed, the case is materially altered when it is noticed that for some miles at each end of the journey the train has to travel along the streets of the two cities, getting along as well as it can, just like a steam tramcar in our streets. It is a strange sight to see a big express locomotive with a large train of the very long bogie carriages wandering along the public streets as if it had lost its way; its approach heralded by the clanging of a great bell on the engine, which is kept going incessantly whilst running through a town as a warning for clearing the way. The engine whistle is never used in towns because of its frightening horses, but they take no notice of the bell. The general speed of American trains is only about two-thirds that of English railways, and on the longest of the railway journeys, the one direct across the continent from New York to San Francisco, the average speed throughout, including all stoppages, is only twenty-two miles an hour.

The remarkable feature in the American railways is the extraordinary length of the lines; there are five separate railway companies working each of them more than 4,000 miles length of line, and one of these as much as 6,000 miles length; and a striking illustration is given by a comparison of the American monthly "Bradshaw," which takes the place of our sixpenny Bradshaw, giving the trains of 19,000 miles of railway in England, Scotland, and Ireland; and the American one is a two-shilling book, with the trains of no less than 143,000 miles of railway in the United States, Canada, and Mexico, and actually amounting to about one half of the total railway mileage of the world.

The line from New York and Philadelphia runs mainly over level agricultural country, and approaching Philadelphia the striking novelty is seen of peach orchards filled with peach trees, standing alone, much like apple trees in appearance, and bearing abundance of capital fruit. This fruit is served plentifully at the stations and also in the trains by lads who are frequently passing through the carriages whilst travelling,

walking through the whole length of the train with baskets of fruit of various kinds, also varieties of sweetmeats of which the Americans take a good deal, and supplies of railway bookstall literature. The ease of travelling the very long distances that are required on American railways is greatly added to by the comfort and convenience of the American Pullman cars, in which you can walk about from one carriage to another, and enjoy fresh air on the open platforms between the carriages. This gives a comfort and ease in travelling that we have no idea of in this country, and it has been found a necessary provision for the very long journeys and continuous day and night travelling that are necessary in getting about the vast continent of America, where, from New York to New Orleans, 1,370 miles, is a two days and nights' journey; and from New York to San Francisco, 3,270 miles, is a six days and nights' journey. The comfort and convenience of the carriages is so great that you do not feel any more fatigue from a couple of days and nights' travelling than from a few hours' travelling in our carriages; on three occasions I travelled two days and nights continuously, and got out of the carriage at the end of the journey as fresh and ready for sight-seeing as if just stepping out of an hotel. The carriages are indeed really travelling hotels, for in parts of the thinly populated West, where refreshment stations are not to be met with, the meals are served and cooked in the train, and are thoroughly well managed.

Entering Philadelphia, the first bridge over the railway is seen; a long bridge, carrying a public road across many lines of railway. As a rule, there are not any bridges over the American railways, and they cross all roads and streets on the level, but the use of bridges is now getting introduced for the safety and convenience of thronged road traffic, and Philadelphia has taken a lead in this matter. Another novelty at Philadelphia Station was hansom cabs at reduced fares; the regular American four-wheel cabs are, in most cities, at the exorbitant fare of four shillings per mile (a dollar per mile).

Philadelphia is the next largest city to New York, having more than 800,000 population, and it contains one of the finest buildings in America, the new City Hall, a very large building of white marble, with four fronts of fine design, standing in the middle of a square in the centre of the city. Also, Fairmount Park, which is celebrated as the largest city park in the world, extending more than a dozen miles along both sides of the river.

Washington was next visited, with its grand Capitol, the Parliament House of the country, which stands on an eminence forming the terminus of a number of very wide, long lines of streets, that are laid out radially from the Capitol in all directions. The Capitol is a very large, noble building, surmounted by a fine dome that is nearly as large and high as that of St. Peter's at Rome, and would contain inside it the dome of our St. Paul's in London.

There has been recently completed at Washington the great Washington Monument, a gigantic obelisk, the tallest structure in the world, and actually 550ft. high from the ground; the highest structure previously being Strasburg Cathedral spire, 470ft. high. Washington city is laid out upon a very ambitious and grand scale, and has very fine lines of streets of great width, but these are at present only imperfectly built up, and the population is only about 150,000.

A day and night travelling then brought us to Louisville, and a further journey southwards to the great Mammoth Cave of Kentucky, which is reached by a drive of eight miles from the nearest station, over a very rough and hilly road. This wonderful cave is a series of limestone caverns and tortuous passages, which are entered from the side of the hill, and extend eight miles in direct distance from the entrance. There has been as much as 100 miles total length of these passages explored, and more still exist; and there are some of the chambers of enormous dimensions, one rotunda that we visited being 175ft. by 100ft., and 100ft. high; and one chamber was 500ft. long and 65ft. high. Five hours were spent in the cave, and a specimen was brought away of the celebrated blind crayfish, and one of the cave crickets caught running over a rock in the depth of the cave.

(To be continued.)

NOTES ON THE RIVER REA AND THE FLORA OF THE REA VALLEY.*

BY HENRY BOYDEN, B.A.

In turning over the pages of a fine old copy of Dugdale's "Warwickshire," in an old Warwickshire vicarage, a few weeks ago, I happened to light on a passage which indicates

* Transactions of the Birmingham Natural History and Microscopical Society, read December 8th, 1885.

the author's view of the derivation of the name which our river bears. Under the head of "Edgbaston," he writes, "The Tame is enlarged by a brook called Rhea, from the British word Rhe, rheawdr, or rheag, as I conceive, which signifies to run or flow, and seemeth to have its origin from the Greek word ῥέω, *fluo*; which torrent hath its rise from the foot of the Lickey Hills in Worcestershire, whence, passing on with a swift course, it enters this county here at Edgbaston, whereof I am next to take notice." With regard to the name of the river, my conjecture is that the old orthography was that which Dugdale here employs, viz., Rhea, and that gradually the "h" was dropt in the spelling, as it was almost sure to be in the pronunciation, till about a century ago, when it was fixed in its present form. On the copy of a very old map, which I saw in the Edgbaston Estate Office, the name is spelt in both ways, which may indicate a transition period.

Adverting to Dugdale's description of the river, we notice that if he seems in one place to write contemptuously of it as "a brook," he makes ample amends further on by calling it "a torrent." And both terms in the description are accurately applied, for the Rea is a mere brook in dimensions through its general course, and it does roll down as a torrent in time of flood. The swiftness of its course is also correctly described, and may be accounted for by the fact of its descent from the Lickey and Frankley Hills, which are elevated about 800 feet above the sea.

From careful investigation of the locality, and personal enquiries among old residents, I came to the conclusion that the Rea has its highest source in a spring which rises midway on one of the Lickey hills, popularly called "The Shoulder of Mutton Hill," approached by a narrow footpath through the cultivated fields of Wetty Farm. The water from the spring trickles down by the side of a hedge, disappears underground, accumulates by field drainage, emerges in its descent towards Rubery, flowing through the village parallel with the Bromsgrove Road, and then round by the Lunatic Asylum, till it is joined midway between Rubery and Long Bridge by a babbling tributary. This takes its rise at the foot of a field descending from Frankley Beeches, flowing through a deep, narrow, shrub-entangled dingle; receiving on its right bank the waters discharged from a drain-pipe, passing in a tortuous course through woods, and then by the railway, till it joins the Rea. After this junction the Rea flows on as a conspicuous stream beneath Long Bridge, through Northfield, King's Norton, and Lifford, receiving at

the Pebble Mill, Pershore Road, the tributary stream of Bournbrook, and passing there out of the county of Worcester into Warwickshire. From thence it flows by Cannon Hill and Calthorpe Park, where it enters on its town conditions, unfavourable to the botanist, and passes through the older part of Birmingham across Deritend, to join the Tame in the neighbourhood of Aston. The Tame, thus augmented, flows into the Trent beyond Tamworth, near to Croxall, and this finds its way into the estuary of the Humber, and so into the North Sea. In tracing the course of the Rea from the Lickey Hills to the German Ocean, the thought was suggested to me whether it would not be well, in addition to the county floras which we have, but the limits of which are artificial, to work out the flora of large natural geographical areas. The ornithologists of Scotland are working on this plan, as I saw by the maps of Mr. Harvey-Brown, during a recent visit. The great natural divisions of that country are more distinctly marked by its mountain systems than our own; but our larger rivers, with their affluents, would form, I think, botanical areas of an instructive character. Thus the Trent Valley might be taken as a large district, and, in connection with it, the sub-districts of the Tame and Anker, which have been so exhaustively worked out by Mr. Bagnall, and the Rea, which I am attempting.

I said that the Rea enters on its town conditions where it leaves Calthorpe Park, and this reminds me of the rapid growth of the town in this direction; for I can remember when the river was crossed by stepping stones where the Gooch Street Bridge now stands; when Barford Street was barred by gates, beyond which were Dester's fields, where I gathered my first wild-flowers, now the populous parish under my ministerial charge; when snipe were shot in the marshy places that became Bishop Street; and when the Rea ran betwixt smiling meadows till it reached the old Apollo Gardens of Moseley Street. But if we consult maps dated 1731, copies of which we can see in Dr. Langford's "Century of Birmingham Life," we shall find that the Rea was a country river through nearly the whole of its course, the main street of Deritend being the only strip of town that intervened; we shall see meadows by Deritend Chapel, divided by hedgerows, diversified by trees, rendered picturesque by an occasional homestead and a windmill, and personally interesting by the couples who stroll on the banks of the Rea in the summer gloaming.

Having traced the course of the river, I will add a few words on the geology of the valley through which it flows.

The whole stretch of valley from Calthorpe Park to the Lickey Hills, a distance of seven or eight miles, seems to be uniformly composed of the Keuper Red Marl of the Triassic system; not presenting, therefore, that variety of formation which is conducive to a richly diversified flora. In the Lickey Hills themselves we have a combination of Llandovery Rocks and Quartzite, which Professor Lapworth describes as "resting upon ashy-looking rocks of Pre-Cambrian age;" but it is only with a portion of the Lickey Hills the Rea Valley is connected. The geographical features of the Rea Valley are also, in some respects, unfavourable to an extensive flora. There is an absence of such primeval bogs as those of Sutton Park, Coleshill, and Hartlebury, with their rare marsh plants and bog mosses, the sphagnums, which are wanting in my collection. Marshy places there are of some, though of less value. Neither have I found extensive woods, though there are some coppices, and, towards Frankley, small woods and dingles, which invite inspection. The valley for the most part is open, and consists of meadows, cultivated fields, and narrow lanes. The principal botanical stations are the Pebble Mill Pool and Pebble Mill Fields, Stock's Wood and canal banks at Selly Wick, and the Dog Pool Lane, Lifford, King's Norton, Northfield, Frankley Beeches, and Rubery. Travelling through the Rea Valley, as now indicated, I will mention some of the principal plants I have found there. The two parks, Calthorpe and Cannon Hill, being modern, furnish little to record, unless it be *Myriophyllum alterniflorum*, in flower, which abounds in Cannon Hill Pool, with the American weed, *Elodea canadensis*. The Pebble Mill Pool is a station that is doomed to pass away, as it is being gradually filled up—a loss to the botanist, but a gain to society, as the scene of some suicides, and pregnant with malaria. If thoroughly searched its yield, I think, would be good. I have obtained there *Nymphæa alba*, though not in flower; *Nasturtium amphibium*, of luxuriant growth; *Lychnis Githago*, a colonist; *Artemisia vulgaris*; *Iris Pseudacorus*, the Yellow Flag; *Carex riparia;* and of grasses, *Digraphis arundinacea* and *Phalaris canariensis*. From the neighbourhood of Selly Wick, including canal banks and Stock's Wood, I have obtained *Polygala vulgaris*, *Genista tinctoria*, *Vicia angustifolia*, *Prunus Avium*, *Rubus Idæus*, *Hieracium vulgatum*, *Lemna trisulca*, the Ivy-leaved Duckweed, and *Carex remota*. The Dog Pool Lane and adjoining fields have supplied me, among other plants, with *Orobus tuberosus*, *Prunus domestica*, *Adoxa Moschatellina*, *Dipsacus pilosus*, the Shepherd's Teazle, *Petasites vulgaris*, frequent along the sandy banks of the Rea; and *Colchicum*

autumnale, the Meadow Saffron, interesting from its peculiarity in putting forth its leaves, flowers, and fruit, and as being in bloom when most of the other flowers are faded and gone. One of my best stations is Lifford, with its combination of canal banks, canals, pools, and marshes. Among the best plants obtained there I would mention *Nasturtium palustre*, in abundance on the muddy shore of Capon's Pool; *Reseda Luteola*, *Viola odorata* (white variety), *Epilobium roseum*, *Sium angustifolium*, a rather rare plant; *Silaus pratensis*, *Senecio erucifolius*, *Stachys palustris*, *Rumex Hydrolapathum*, *Sparganium simplex*, and *Sparganium ramosum*, the branched Burweed; *Potamogeton pectinatus*, *Sagittaria sagittifolia*, *Alisma Plantago*, var. *lanceolatum*, *Scirpus setaceus*, rare; and *Carex vulpina*. King's Norton, perhaps through want of more accurate search, has furnished nothing worthy of special note, but Northfield has proved a more fertile locality. Among many plants obtained there I select for mention *Ranunculus aquatilis*, *R. sceleratus*, and *R. arvensis*, *Cardamine amara*, a good local plant; *Chelidonium majus*, *Lychnis vespertina*, common, but rare in the Rea Valley; *Malva moschata*, *Pyrus malus*, *Circæa lutetiana*, *Sedum acre*, *Centaurea Cyanus*, a colonist; *Achillea Ptarmica*, *Hieracium umbellatum*, rare; *Campanula latifolia*, the Giant Bell Flower, abundant and luxuriant on the railway bank; *Convolvulus sepium*, *Orchis maculata*, *Listera ovata*, and *Narcissus Pseudo-narcissus*, the latter a common plant which deserves special mention here as giving a name to a locality,—the Daffodil Fields—meadows on either side of the Rea, made golden by a profusion of these glorious wild flowers, these early gleams of a returning spring. Of the grasses of this district I would name *Aira cæspitosa*, *Melica uniflora*, *Triticum caninum*, and *T. repens*. Several members of the Society also report the Snowdrop for this locality. Proceeding from Northfield to Frankley Beeches along the lanes, I cull *Epilobium angustifolium*, rare in the Rea Valley; *Bryonia dioica*, *Tamus communis*, *Asperula odorata*, *Primula vulgaris*, strangely rare in the Rea district; *Epipactis latifolia*, abundant in the copse of Frankley Beeches; and *Epipactis media*, nearer Rubery. Rubery, with its neighbouring hills, the watershed of the Rea, I have not yet worked out, but I would mention *Corydalis claviculata* and *Geum rivale*, the Water Avens, as good plants, also *Salix pentandra* and *Typha latifolia*; and from the "Shoulder of Mutton Hill" *Lycopodium clavatum*, never previously recorded as part of the flora of the Lickey Hills. The Rev. J. H. Thompson also records, for the first time, *Melampyrum montanum*, from Rednal Hill, in the year 1884.

The Rea Valley, so far as I have been able to discover, is not rich in the cryptogamic flora. Of the ferns I have to mention seven species, viz., *Pteris aquilina*, *Lomaria spicant*, *Asplenium Ruta-muraria*, found by Mr. R. Moore, on Moseley Park wall, since pulled down; *Aspidium aculeatum*, *Nephrodium filix-mas*, *N. spinulosum*, and *Polypodium vulgare*. Of the horsetails I have to mention six species—*Equisetum arvense*, *E. sylvaticum*, *E. palustre*, *E. limosum*, and two taken from Mr. W. Mathew's list, *E. maximum* and *E. hyemale*.

The mosses of my district are not so numerous as I expected, or else my eye is not sufficiently acute to detect them. I have to record forty-five species, most of them being such as might be expected to grow in a marly district like the Rea.

All my critical flowering plants have been submitted to the Rev. J. H. Thompson, and Mr. W. Mathews, who have kindly examined them; and all the mosses have been seen, and for the most part named, by the kindness of Mr. James E. Bagnall.

All the plants obtained in the Rea Valley I have catalogued, adding some from Mr. Mathew's excellent little book, "The Flora of the Clent and Lickey Hills," as belonging to my district. Counting up my gains, with this list before me, I find that my plants represent sixty-seven out of the ninety-three natural orders named in the London Catalogue; and 326 species out of the 1,665, exclusive of the mosses. I hope very largely to increase my list by further search, and publish it later on in the year.

I will not further trespass on your patience except to speak a word in behalf of our little Birmingham river, to which I am bound in attachment by the pleasant memories of many years. No poet that I know of has sung its praises, but on the contrary, the mention of its name is the signal for mirth on all occasions. The Archbishop of Canterbury, in his Presidential address at the Midland Institute, provoked much laughter by his allusion to "the silvery and sportive Rea." That it was silvery in good weather in early times I am sure, and sportive also, as its present windings and eddies testify. As a river it may be despicable, but the valley through which it passes is by no means to be despised. It can boast, in near neighbourhood to the town, two parks—the people's pleasure grounds, Calthorpe Park, attractive to the lovers of athletic exercise; and Cannon Hill, which should, by reason of its beauty, be attractive to everybody, and which by a moderate outlay, as suggested in the public

prints, might be made very useful for botanical studies.* The Pebble Mill Fields are very pretty and inviting when aglow with the buttercups and daisies of early summer, and as flanked with the wooded uplands of King's Heath and Moseley; and the landscape is improved when the valley widens out towards Northfield, with a distant view of the Lickey Hills, from which the Rea descends, fringed with briars, willows, alders, and hazels, haunted by the Water Voles, and here and there made resplendent by the swift flight of the Kingfisher.

THE MONUMENTAL BRASSES OF WARWICKSHIRE.

BY E. W. BADGER, M.A.

(*Continued from page 126.*)

EXHALL, near Alcester.—*John Walsingham, Esq.,* 1566, *and w. Elenor. Haines.*

One of the most pleasing brasses in the county, the style and drawing being admirable. The man is 1ft. 11in. high, the woman 1ft. 10in. The former has close-cropped hair, moustache, and beard. Round his neck is a ruff, which fits closely upon a narrow gorget of plate. The *pauldrons* are large, and have a lining with escalloped border; they are fastened by staples and spring-pins. The *coutes* are small and elegant, and the hinges of the *rambraces* are plainly shown. The hands, which are well drawn, are bare. The breast-plate is ridged, and to it are fastened, by hinges, two large *tassets*, which are kept in their place by straps passing round the thighs. The *genouillières* are similarly fastened. The sword-belt does not go round the body, but is fastened to a ring at the right side of the breast-plate; the sword has the modern guard. This armour belongs to a period about fifteen years later than 1566, so that we seem to have here another instance of a brass put up some time after the decease of the person it represents. (See Compton Verney III.)

* The suggestion as to the utilising of Cannon Hill Park for the purpose of Botanical Science came first from Mr. Oliver, and I have recently learned that he is laying out a portion of the park in a series of beds to show specimen plants of the European natural orders. The smaller pools might be economised for the growth of aquatic plants, and botanical knowledge would be imparted if the names, Latin and English, of the less familiar trees and shrubs were conspicuously attached to them.

The lady has a French hood, a ruff, and a loose outer gown thrown open from the neck downwards, except where it is confined by a sash at the waist. A richly-embroidered bodice and petticoat are thus disclosed, the former having striped sleeves with cuffs. Above the effigies are two shields, each 6in. long. One, part of which is lost, bears the arms of WALSINGHAM : Quarterly, 1 and 4, paly of six, arg. and sa., over all a fess gu.; 2 and 3, gules, a cross coupeè compony arg. and az., bet. 16 bezants. The other shield is for ASHEFIELD . arg. a trefoil slipped sa., bet. 3 mullets, gu.

The inscription is upon a plate 1ft. 7½in. by 4½in.

Here lieth buried the bodies of John Walsingham late of Exhall in ye | County of War' Esquire and Elenor his wyfe one of the daugh= | ters of Humfrey Ashefield late of Heythropp in the countye of | Oxford Esquire. The same Joh decessed the xxth day of January | 1566. And ye said Elenor decessed the

The wife was probably buried elsewhere. (Compare the Aston brass.)

There is no monumental brass at HALFORD, as stated by Haines. In the chancel, however, is a stone incised with the figures of a cross and chalice.

HAMPTON - IN - ARDEN.—*A civilian, c.* 1500. *Haines.*

In the nave of the church lies an effigy, 14in. high, of a man in civil costume. The tombstone in which it is inlaid has matrices for a woman's effigy and an inscription, both of which are lost.

The man has long hair, and wears a gown with wide sleeves, edged with minever at the neck and cuffs. The collar and sleeves of an under garment are visible. From the left side of the civilian's girdle hangs a *gypcière* or pouch, and from the right a rosary.

It is doubtful whom the brass represents. Dugdale records a brass to "Ricardus Brokes baliuus de Hampton in Ardene et Isota uxor ejus." Haines refers to the "Gentleman's Magazine," 1795, Part II., p. 988, where the following inscription is printed :—

Mon yt behoves the off to have i mynd
yt yo delyst wt yn hand yt shalt yo fynde
Childyr bene sclothil & wiffys ben unky'd
Excekutiors covetose & kepe at yt yyr y fynd
Hic jacent Ricardus Stokys Salter de hampton in Ardenie
Et Isota uxor eius quor' aiabus p' picietur deus amen.

Dugdale gives the same verses, modernised; they were common on gravestones at the end of the fifteenth century, and a longer version will be found in Weever's "Ancient Funeral Monuments." Whether our brass is in memory of Richard Brokes, bailiff, or Richard Stokys, salter, it is impossible to decide. Perhaps there were once two brasses, and the inscription has been misplaced. Too much weight, however, must not be given to the statement in the "Gentleman's Magazine," which is evidently inaccurate in describing the brass as that of a "*woman* holding a rosary and purse." The words "yyr y" in the fourth line of the inscription may be a misreading of "yey," *i.e.*, "they."

An illustration of the brass will be found in the Transactions of the Archæological Section of the Birmingham and Midland Institute, 1878-9, p. 8.

HARBURY. I.—*Alice Wagstaff*, 1563. *Haines.*

This brass is now at the west end of the nave. It consists of several plates, one of which, 21in. by 5in., placed at the head of the tombstone, contains this inscription:—

Ales Wagstaff sometyme Savage wife, heare sleapeth in the duste | Whose Image shoes whereof we be, and where unto wee must | Her life well spent, a deathe did brynge, agreable to the same | Whose vertues in the boke of liefe, recorded hath her name | God graunt all those that present be, or shall heareafter pas | Suche gift of grace, suche perfett liefe, as in that matron was. |

A plate, 3in. by 1in., is lost from its position below and adjoining this larger plate. Possibly it contained the word "Amen." Beneath this is a space enclosed by three strips of brass, with the following inscription; on a fourth, loose in the Rector's study, the words are illegible:—

✠ Beholde the ende my children all, and marke yt well or ye begynne | To deathe are ye subject and thrall, take hede therefor and flie from synne |

(Third line illegible)

And liefe agayne shall springe and growee, where deathe hath reapt and also mowen

Within this enclosed space were the effigies of Alice Wagstaff and her children. The lady's figure and a group of children are lost; one girl only is left, dressed in French hood, ruff, and gown with falling collar and tight sleeves

puffed at the shoulders and frilled at the wrists. There are two plates, 8in. by 4in., near the head of the principal figure. That on the right enumerates

[The parent of this Alys]
Thomas ffurnor the sonne
of Willm̄ ffurnor & Alys
ffurnor the daughter of
Willm̄ Tyrrold.

The left hand plate details

Her bretherne & systers
William ffurnor and John
ffurnor Anne ffurnor
and Jone ffurnor

At the bottom of the tombstone is a plate $20\frac{1}{4}$in. by 4in., inscribed thus: —

This Counsell good this mother deare, unto her children gave | In lieffe to learne, souche deathe to dye, a better lieffe to have | By coursse of kynde her liefe sursesd, the twenty-fourth of Maye | for whose swete soule amonge the rest, I do most humbly pray | Anno dn̄i | 1563.

There has been an attempt, probably by a Puritan, to erease the word "pray" in the last line of this post-Reformation prayer for the dead.

II.—*Anne Wagstaff*, 1624. *Haines.*

A small plate, 1ft. by 5in., in a moulded tablet upon the south wall of the chancel, bears this inscription:—

ANNE WAGSTAF DAVGHT' TO IO' HANSLEPP
OF STONITHORPE HEARE DOTH LYE
WHOSE VERTVOVS LIFE DID WELL DESERVE
ETERNAL MEMORYE. QVE OBIIT
AN° DOMINI 1624.

III.—*James Wright, Gent.*, 1685. *Haines.*

Like No. I., this brass has been placed at the west end of the nave. It consists of two plates; the upper one, which is 2ft. square and placed diamond-wise, bears the crest, a dragon's head ppr. issuing out of a ducal coronet or., and the arms of WRIGHT:—az., two bars arg., in chief three leopards' heads or., impaling WAGSTAFF arg., two bends engr., sa., the under one couped at the top, in chief an escallop of the second.

The lower plate, 2ft. 9in. by 10in., is inscribed :—

HAC IACET SVB VRNA CORPVS IACOBI WRIGHT GENEROSI
QVI OBIIT DVODECIMO DIE SEPTEMBRIS ANŌ CHRISTI
MILLIMO SEXCENTESIMO & OCTOGESIMO QVINTO
ÆTATIS SVÆ 61, CVIVS ANIMA REQVIESCAT IN PACE

Hac bene qui meruit tumulatur Regis in urna
Et patriae uiuens uerus amator erat
Optima prima fere manibus Rapiuntur auaris
Implentur muneris deteriora suis.

Translation :—

Under this tomb lieth the body of James Wright, gentleman, who died on the 12th of September, 1685. May his soul rest in peace.

Beneath this tomb is buried one who deserved well of the king, and who in life was a true lover of his country. The best things are generally the first to be snatched from our greedy hands, the worse things are filled with their full numbers, *i.e.*, are undiminished.

In order to make any sense of the last line, "numeris" has been conjectured for "muneris," which will neither scan nor give sense. There seems to have been an attempt to change "tumulatur," in line 1, into tumulator, which means nothing. Regis is curious Latin. The seventeenth century prayer for the dead is remarkable.

(To be continued.)

THE LATE REV. W. W. NEWBOULD, M.A., F.L.S.

A FEW PERSONAL REMINISCENCES

BY J. E. BAGNALL, A.L.S., AND W. HILLHOUSE, M.A., F.L.S.,
COMMUNICATED BY THE LATTER.

The breadth and depth of the feeling which the news of the death of Mr. Newbould will have called forth, especially in the Midland Counties, appears to demand, in the pages of the "Midland Naturalist," something more than the brief reference to it in the last number (p. 142). To those who had come across him—and who in the ranks of active local botanists had not?—his loss will seem rather that of a dear personal friend than of a mere working colleague; of a companion in arms, rather than of a fellow-soldier. And, indeed, Mr. Newbould was no mere working colleague. The very

incarnation of self-abnegation, nothing was to him a source of greater happiness than to place his time, his brains, his critical experience freely at the disposal of some younger man who seemed in need of them. This he did ungrudgingly. He asked no return. Notoriety he sought not. To see his name in print brought to him not the smallest quickening of the pulse, unless, indeed, from a feeling of abashed humility. And yet, for all this, few men have done so much work, patient hard work, in connection with local floras, as he has.

It was my lot in the years 1875, '76, and '77, and to a lesser degree in the two following years, to devote my whole spare time to the compilation of materials for a reissue of the Flora of Bedfordshire. It was in this connection that I, as so many others have done, first became acquainted with Mr. Newbould. This was in June, 1876. I had sent to him a copy of my "Plant List for 1875" (Trans. Beds. Nat. Hist. Soc., Vol. I., p. 65), and received in acknowledgment a letter full of kindly sympathy and encouragement—a letter such as, in my experience of critical botanists, only he and the late Hewitt Cottrell Watson could write. It so happened, however, that just then another tie between us had arisen in a way which to me was a grateful surprise. I was at the time just beginning life, botanically speaking, in another sense, in that I had just commenced a course of lectures on Elementary Botany to a class of about 100 boys from the lower forms of the Grammar School at Bedford—boys varying between nine and eleven years of age. Amongst these were two of Mr. Newbould's own boys, who were being educated at that School. No one could feel so much as I could myself how desperately hard this task was to a beginner. Years have only accentuated the feeling of failure which I had at the time. How grateful to a young beginner, full of a love for his subject, but fuller still of a sense of inability to teach it properly, to be told at this beginning of the work, "I was very glad to learn a few weeks ago that one of my boys had come under your tuition. If you can but teach him any one thing *well and accurately* I should not much mind what he does not learn. All the rest will be only a mere question of time" (June 17, 1876); and again a few months later (Aug. 7, 1876), "You have contrived to get a monstrous quantity of botany into my lads, and they have much improved in other ways. Many thanks to you for this." Only those who know and have felt the sickening sense of failure can realise what precious balm this was to me, and how it spurred me on to try and do indeed what the kindly heart of Mr. Newbould had prompted him to attribute to me.

I am fully aware that this is very personal, and to most will be very trivial, but it is to the full characteristic of the heart and disposition of the man, and as such I mention it. This, then, was the beginning of Mr. Newbould's direct assistance in my work on the Bedfordshire Flora—work which the local society is still actively pushing on.

In one of my botanical rambles with him in South Beds (August 9th, 1876), a curious incident occurred, illustrating in a remarkable way the restricted nature of vision. We came across a little bare patch in the corner of a field, shortly after we had sat down and marked off nearly 200 plants as seen. Pointing to the ground, Mr. Newbould said, "There's a new plant for to-day." I stooped and picked up the fruiting stage of *Carum bulbocastanum*, which at once caught my eye. To my surprise, he said he had not seen that plant, and picked up *Fumaria densiflora*, which grew side by side with it. It seemed impossible not to have seen the two at once; perhaps, though, it was not surprising that my less trained eyes should have fixed upon the more conspicuous plant, but it was very remarkable that he himself had not seen the *Carum*. I need hardly say the tenour of our conversation for some minutes was turned to things non-botanical.

Perhaps the most interesting hours, botanically speaking, I remember, were spent with Mr. Newbould and the late Mr. R. A. Pryor, B.A., of Hatfield, a botanist of well-known critical ability, in the critical examination of the Herbarium of Abbott, the author of "Flora Bedfordiensis," which, by kind permission of its owner (the late Mr. Chas. Longuet Higgins, M.A., of Turvey Abbey, Bedfordshire), was passed over into my possession for a few weeks. I had carefully examined this from beginning to end, and made copious notes; then we three worked through it together. For a long time the results were used mainly for my own purposes, but at length Mr. Pryor compiled them anew, with some literary additions, and they were published by him in the "Journal of Botany" for 1881, pp. 40 and 67. One of Mr. Pryor's last journeys before his too early death (February 18th, 1881), was to see me at Cambridge in connection with this matter. I know what a shock his death was to Mr. Newbould, though not altogether unanticipated by him; and several times he expressed surprise why a feeble old man like himself, who could do so little, should be spared, while one comparatively young, and of brilliant promise, should be taken away. This again illustrates Mr. Newbould's characteristic and genuine humility.

Mr. Bagnall's first note from Mr. Newbould was dated August 17th, 1880. Mr. Newbould was then temporarily residing at Honington Hall, near Shipston-on-Stour, and his letter spontaneously offered Mr. Bagnall assistance in his "Flora of Warwickshire," as far as the Stour district was concerned, in which he ultimately recorded about 420 plants. Mr. Bagnall, about ten days later, had a day excursion with him, and describes him as "one of the most interesting companions I had ever met." During this visit Mr. Newbould seems to have persuaded Mr. Bagnall to adopt river basins as his basis for county divisions, instead of the main roads he had originally intended to take. I well remember that some of my most animated discussions with Mr. Newbould were on this same point in connection with the Beds Flora, as I resolved (most presumptuously I knew) to take a geological division of the county, primarily into chalk, gault, greensand, and oolitic clays (Beds. Nat. Hist. Soc. Trans., March 9th, 1876). Just as with myself, Mr. Newbould made Mr. Bagnall the recipient of every atom of information about Warwickshire Flora he could scrape together, and as for years he had spent his winters almost wholly in the Reading Room and Herbarium of the British Museum, his collections of literary notes were peculiarly extensive and valuable. It may further illustrate the way in which he placed his time at the disposal of those whom he sought to help, that on his return to London he specially searched through the British Herbarium at Kew and the British Museum, for all information as to Warwickshire plants, giving transcripts of all notes of other botanists on the labels, and subsequently did the same thing with Professor Babington's Herbarium at Cambridge. All this material he freely handed over to Mr. Bagnall.

I have thus far trespassed on the space of the "Naturalist" to illustrate a character, alas! comparatively rare. A man in whose thoughts and actions self comes really last, is worthy of more than a passing thought. I can but wish that my dull labouring pen were more capable of worthily disclosing the pure refined gold of one of the brightest characters within the sphere of whose influence it has been my lot to come.

FUNGUS-HUNTING IN SPRING.—II.

BY W. B. GROVE, B.A.

One of the most fascinating pursuits of the embryo mycologist is that of searching for leaf-fungi, for these are easy to find if one but goes the right way about it, and when found are, in general, easily determined. The distinctions of the genera are not difficult to comprehend, and the species of the host-plant is, in nine cases out of ten, an infallible guide to the name of the parasite. And then one has, in Cooke's "Microscopic Fungi," a convenient and ready helper in the study.

To the mycologist it is one of the delights of spring that with its return there returns also the opportunity of finding these devourers of the tender leaves. This is the way for the beginner to commence his work. Having first obtained the indispensable book just mentioned, let him look therein for a species which is described as common, or, at least, as not rare, and which occurs in spring. *Uredo confluens*, which grows in May and June on the Dog's Mercury (*Mercurialis perennis*), is a good example of what I mean. In this district the host-plant is extremely abundant. One can walk for miles along the country lanes and find large patches of it every hundred yards or oftener. Moreover, coming so early as it does, before the hedge-rows are in leaf and before other and taller plants are advanced enough to overshadow it, this plant is easily detected and examined.

Now although all the leaf-fungi do not produce conspicuous markings upon the leaves on which they grow, yet the majority of them, including the one in question, do. Hence all that is necessary for the discovery of *Uredo confluens*, if it occurs in the district, is to walk a certain number of miles in country lanes, and patiently but superficially glance over every patch of *Mercurialis* one's eyes may fall upon. If it is there, before long the eyes will be rewarded with a sight of a brilliant yellow blotch on a leaf or on a stem, and on closer examination the flat erumpent pustles of the *Uredo* will be seen, crowded together (on the leaves at least) in a more or less concentric form.

The same process will be equally effective in finding the *Puccinia* on Anemone, and the Cluster-cups on Viola and on Ranunculus, always supposing that they occur at all in the district examined. I speak from personal experience when I say that this method of starting with a definite object, with the intention of finding a particular fungus which one has

ascertained previously from books to grow upon a certain host-plant is far more like to be successful than an indiscriminate search for whatever may turn up. Of course it is only fully applicable to those which grow upon common plants, and if the fungus is not there we shall never discover it. But it must not be forgotten that the species of leaf-fungi are not equally abundant every year, and if we do not succeed one year we may the next.

It was by this process that I at last succeeded, three years ago, in discovering *Triphragmium ulmariæ* on the Meadow Sweet. But this is an autumn fungus, and my present purpose is to enumerate those species of the group which have been found in this neighbourhood in spring—let us say before the fourth week in May. I shall mention none but those which I have seen myself; a few of them have been gathered and sent to me by Mr. H. Hawkes and Mr. W. H. Wilkinson.

To begin with the Cluster-cups. The commonest species, at this early date, is *Œcidium ficariæ*, which is found in April and May on both *Ranunculus repens* and *R. ficaria*, most abundantly on the former. I have specimens from King's Heath, King's Norton, Northfield, Alvechurch, Kingswood, Temple Balsall, Hampton, Fillongley, Shustoke, Water Orton, Langley, and Hunnington. *Œ. lapsanæ* is the earliest I have found; it occurred on *Lapsana communis*, at Blackwell, before the end of March. *Œ. urticæ*, on *Urtica dioica*, from Alvechurch, Fillongley, and Shustoke; *Œ. violæ*, on *Viola Riviniana*, from Kingswood, Packington, and Sutton; and *Œ. depauperans*, on cultivated Violas, at Perry Barr and Sutton, all in May. Mr. Hawkes has sent me *Œ. tragopogonis*, from near Great Barr, on Goat's Beard.

Of the Puccinias, *P. adoxæ* is the earliest, having occurred on *Adoxa moschatellina*, near Blackwell, before the end of March; *P. anemones*, at Middleton and Northfield, in April; *P. ægopodii*, from Shustoke and Erdington, in May. Mr. Hawkes has also sent it me from Northfield. I once found *P. malvacearum*, at Alvechurch, on *Malva sylvestris*, in the first week of May; it does not become abundant till June. *P. coronata* has occurred on sheaths of a species of Aira as early as the middle of February, but these specimens were, of course, those of the preceding year. The *Uredo* spores of *P. graminis* can also be occasionally met with before the middle of May; and Mr. Wilkinson has sent me those of *P. luzulæ*, from Gnosall, in April.

The curious jelly-like fungus, *Podisoma juniperi*, has occurred on Juniper trees at King's Norton, and was sent to me by Mr. C. Pumphrey.

Of the Phragmidia, one can occasionally find the teleutospores of *P. violaceum* on leaves of *Rubus fruticosus* which have stood the winter. The uredo-stage (*Uredo potentillarum*), and I believe the œcidium-stage too, of *P. obtusum* are common wherever *Potentilla fragariastrum* grows; and the teleutospores of the previous year also frequently linger on the dead leaves which still remain attached to the root-stock of this plant. Mr. Wilkinson once sent me the uredo of *P. mucronatum*, on young Rose leaves, from Gnosall, in April.

The only one of the unattached Uredos that I have found is *U. confluens*, already mentioned. I have specimens from King's Heath, Northfield, Temple Balsall, Hampton, Packington, Maxtoke, Shustoke, and Hunnington. It is unusually abundant this year.

Uromyces ficariæ is tolerably common on leaves and stems of *Ranunculus ficaria* throughout the whole of April and May. I have specimens before me from King's Norton, King's Heath, Temple Balsall, Marston Green, Fillongley, Sutton, and Middleton. *U. rumicis*, the *Uredo bifrons* of the "Handbook," has occurred on *Rumex acetosa* at Marston Green about the middle of May; and Mr. Hawkes has sent me *Uromyces concentrica*, on leaves of *Scilla nutans*, from Northfield, about the same time.

Among the Ustilagineæ of spring I have specimens of *Urocystis pompholygodes* on leaves of *Anemone nemorosa* from Barnt Green, Kingswood, and Maxtoke. This fungus is probably widely distributed. Mr. Hawkes has sent me an imperfectly developed specimen of *U. violæ* from Penns. I find *Entyloma ficariæ*, Fisch. von Wald., rather common on leaves of *Ranunculus ficaria*, on which it produces small angular whitish spots, which have a mealy appearance on the under side. It has occurred at Northfield, Coleshill, Packington, Maxtoke, and Shustoke, and can no doubt be found everywhere by searching for it in the early part of May.

Peronospora ficariæ is another fungus which afflicts this long-suffering phanerogam. I have not found it myself on *R. Ficaria*, but on *R. repens* and *R. acris*, at Water Orton and Sutton, in May. *P. parasitica* grew on *Alliaria* at Northfield, and on some other *Crucifer* at Sutton; *P. nivea* on *Angelica* and *Anthriscus sylvestris*, at Water Orton and Sutton; and *P. gangliiformis* on Groundsel, also from Sutton, all in May. I mention these because some persons include under the head of Leaf-fungi the species of *Peronospora*, which, however, are not allied to the Leaf-fungi proper.

This concludes the list of all the species of Leaf-fungi of which I have seen specimens from this neighbourhood in

spring. It is obvious that there are several other early species which may be expected to occur about here, and these will no doubt turn up in future years. I shall be glad to receive specimens of these from any members of the Birmingham Societies who may be fortunate enough to meet with them and kind enough to help me in completing this branch of the Fungus Flora of the district.

THE PRINCIPLES OF BIOLOGY.*

BY HERBERT SPENCER.

Exposition of Chapters XI. and XII., "Direct Equilibration" and "Indirect Equilibration."†

BY CONSTANCE C. W. NADEN.

By Mr. Spencer's expression "a moving equilibrium," we are to understand a mechanism the parts of which are in a state of constant activity, and yet preserve equilibrium with regard to each other and to external forces. The mechanism may be organic or inorganic, its component parts may be atoms, heavenly bodies, or the organs of the human frame, but their movements, of whatever kind, must always be rhythmic. The Solar System is a moving equilibrium—so is a watch—so too is a plant or animal.

Now if any fresh incident force affects the mechanism it will either destroy the rhythmic motions altogether, as when I wind my watch too far and break its mainspring; or it will go on modifying the motions till a new equilibrium is established, as when I move the regulator of my watch from slow to fast.

Every plant and animal is daily receiving from without fresh energy, in the place of that which it daily expends. Its food supplies it with heat, which is converted into various modes of motion. But the resulting equilibrium may be disturbed by a lack of food, by altered climate, by the introduction of hostile or helpful organisms, by increased or diminished power of assimilation, or by other natural causes. A change of state will gradually be brought about; the primary disturbance originating secondary and tertiary dis-

* Transactions of the Birmingham Natural History and Microscopical Society—Sociological Section.

† Miss Naden's paper on Part III. of Mr. Herbert Spencer's *Principles of Biology*, Chap. I., "Preliminary;" Chap. II., "The Special Creation Hypothesis;" and Chap. III., "The Evolution Hypothesis," has been published in a separate form.

turbances, and so on until the whole organism is modified and equilibrium restored. Or it may be that the disturbance has been too great and the organism dies.

Equilibration may be *direct* or *indirect.*

It is direct when the new force calls forth the counteracting force, indirect when it is balanced by a change which it has no share in producing.

Direct equilibration is usually spoken of as *adaptation.* It occurs when the force operates on individuals continuously or frequently, not inflicting vital injuries. In this manner light and heat act on the stems and leaves of plants, and the skin of animals ; the effects of use and disuse of organs also must be classed under this head.

Indirect equilibration is a result of the process known as Natural Selection. Many beneficial modifications cannot be directly produced by the environment. The propensity of cattle to browse on a plant would not tend to clothe it with thorns or stinging hairs; nor would the tastes of pollen-carrying bee or butterfly help to develop honey in a flower.

The individuals of a species become unlike by the transmitted effect of the joint variations of the parents ; a complex train of new variations being set up in the offspring. If any change occurs in the environment some of these individuals will be better able than others to accommodate themselves to it, and will have a better chance of surviving and producing offspring to which their peculiarities will be transmitted. Thus a type will gradually be formed in harmony with the new conditions. Even where there is no alteration in external forces, a more delicate adjustment to existing conditions may still be possible. and those individuals which show this adjustment are likely to survive their less fortunate fellows.

A *species* may thus be regarded as a moving equilibrium, yielding in the direction of least resistance and regaining its balance by a compensating reaction.

Leafing of Oak and Ash.—During the first and second weeks of May I had several opportunities of observing the progress of foliation in these trees over a great part of North Warwickshire. Although individual exceptions were numerous, yet it was obvious that by far the great majority of the oaks were about a week or ten days in advance of the ashes. If the proverb were true this would presage a warm and dry summer. The exceptions are due to the constitutional differences of individuals. We are familiar with such variations in the different kinds of garden peas and strawberries, &c. ; and I am acquainted with a horse-chestnut, in Edgbaston, which now for many (perhaps eight) years I have observed to be in full leaf more than a week before all others in its vicinity.—W. B. Grove.

METEOROLOGICAL NOTES.—April, 1886.

Atmospheric pressure underwent several variations during the month, the highest point being 30·301in. on the 15th, the lowest 29·182in. on the 8th. The mean temperature was about one degree below the average. The earlier part of the month was decidedly cold, the maximum not reaching 60° until the 19th. From the 23rd to the 27th the weather was more seasonable. The highest readings occurred on the 27th, when maxima of 71·0° were recorded at Loughborough and at Henley-in-Arden (also on the 24th), 66·7° at Hodsock, and 65·8° at Strelley and at Coston Rectory. In the rays of the sun, 123·1° at Hodsock on the 25th, and 117·9° at Loughborough and 115·2° at Strelley on the 27th. The lowest readings were 27·0° at Hodsock on the 30th, 28·0° at Coston Rectory on the 12th, and at Henley-in-Arden on the 11th and 30th, 29·0° at Strelley and 29·2° at Loughborough on the 11th. On the grass, 17·2° at Strelley, 19·8° at Hodsock, and 24·6° at Loughborough on the 12th. The minimum readings were not unusually low; the deficiency in the mean temperature is attributable to the low maxima. Rainfall was slightly above the average, the frequency of the falls contributing to this result rather than their amounts. The totals were: 1·88ins. at Henley-in-Arden, 1·77ins. at Loughborough, 1·66ins. at Hodsock, 1·59ins. at Strelley, 1·47ins. at Coston Rectory. The number of days on which rain or snow fell varied from fifteen to eighteen. Snow fell at Loughborough on the 9th, 10th, and 11th. Thunderstorms visited Strelley and Loughborough on the 10th. Sunshine was about the average. The wind was strong during the earlier portion of the month, chiefly from south-westward. A solar halo was observed at Loughborough on the morning of the 7th, and a lunar halo on the 11th.

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Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—General Meeting, May 4th. Mr. J. Rabone and Mr. W. B. Grove, B.A., gave a report on the excursion to Chirk on Easter Monday; Mr. T. Bolton exhibited *Lynceus macrourus*, a rare entromostracon and Mr. J. Edmonds exhibited photo-micrographs of the same; Mr. T. Bolton also exhibited *Physa fontinalis*, variety *inflata*, with its curious fringed mantle; Mr. J. E. Bagnall, A.L.S., exhibited *Hypnum brevirostre*, new to the district; *Orthotrichum stramineum*, new to the district; *Primula intermedia*, *Viola hirta*, and other plants, from the Arrow district; he also exhibited, on behalf of J. B. Stone, Esq., *Hypnum brevirostre*, from Dartmoor; and on behalf of Mrs. S. C. Beck, *Peziza venosa*, from Crowell Rectory, Oxon. Mr. W. B. Grove, B.A., exhibited *Diderma globosum*, on dead leaves; *Phoma leucostigma*, *Trochila craterium*, *Coniothyrium Hederæ*, on ivy leaves; *Œcidium ficariæ*, on *Ranunculus repens*, and *Rhytisma acerinum*, on sycamore leaves, all from Chirk. *Œcidium ficariæ*, from Hunnington and King's Norton; *Uromyces ficariæ*, from King's Norton; *Entyloma ficariæ*, from Northfield, all on *Ranunculus ficaria*; *Uredo confluens* from Halesowen, on *Mercurialis perennis*; *Puccinia anemones*, from Northfield, on *Anemone nemorosa*; *Colpoma quercinum*, on young oak twigs, from

Temple Balsall; and several other fungi. Mr. T. Clarke exhibited *Lynceus macrourus*, showing young; *Argulus foliaceus*, in the larval state; and the larva of the Water Feather, *Ocyethira coltalis*.—BIOLOGICAL SECTION, May 11th. Professor W. Hillhouse, M.A., in the chair. Prof. Hillhouse exhibited, on behalf of Miss Taunton, the Rose of Jericho, *Anastatica hierochuntia*, and gave an interesting account of its hygroscopic properties, and related some of the legends pertaining to it. This exhibition led to an interesting discussion, in which the President and Messrs. J. Morley, W. H. France, and J. E. Bagnall took part. Mr. W. B. Grove, B.A., exhibited *Ranunculus auricomus* from Kingswood; and fungi, *Lepiota cepæstipes*, growing on cocoa nut fibre in a hothouse at Sutton; *Œcidium ficariæ* on *Ranunculus ficaria*, *Uredo confluens* on *Mercurialis* from Temple Balsall, *Œcidium violæ* on *Viola Riviniana*, *Uredo fragariæ* on *Potentilla fragariastrum*, *Urocystis pompholygodes* on *Anemone nemorosa*, all from Kingswood, and *Diatrype verrucæformis* on hazel from Packington; on behalf of W. H. Wilkinson, *Œcidium adoxæ* from Loch Lomond. Mr. J. E. Bagnall, A.L.S., *Primula polyanthus* with foliaceous sepals, a case of reversion—*Barbarea intermedia*, *Prunus cerasus*, *P. insititia* from Coughton, male and female plants of *Fontinalis antipyretica* from Weddington, with microscopical preparation to show male flowers, also a series of mosses and hepatics from the Arrow district. For Mr. Alderman J. B. Stone, J.P., *Eucalyptus*, with notes on its peculiarities of growth, &c., and a collection of mosses and hepatics from the Riviera, Dartmoor, &c. For Mr. W. Mathews, M.A., *Barbarea stricta*, *Cicuta virosa*, and other flowering plants. For Mr. R. M. Christy, a beautiful double variety of the lady's smock, *Cardamine pratensis, plena*, from a field belonging to Mr. Frederick Impey, at Longbridge, near Northfield, very abundant; the variation in the flower Mr. Impey believed to be due to liberal manuring. Mr. J. Morley exhibited on behalf of Mr. T. Clark *Holopedium gibberum* from Grasmere.—GENERAL MEETING, May 18th. Professor Ernst Haeckel, of the University of Jena, and Professor Edwin Ray Lankester, M.A. (Oxon), of the University College, London, by the recommendation of the Committee, were elected Honorary Vice-Presidents. Mr. T. Bolton exhibited *Dinocharis pocillum*, the skeleton wheel animalcule. Mr. C. Pumphrey exhibited *Podisoma juniperi*, a fungus from a tree in his garden. Mr. J. E. Bagnall, A.L.S., exhibited *Equisetum maximum*, horsetail; *Convallaria majalis*, lily of the valley; *Orchis mascula*, the male orchis; and *Rhamnus catharticus*, the buck thorn, from the Arrow district. Mr. W. B. Grove, B.A., exhibited *Peziza vesiculosa*, from Water Orton; *Œcidium violæ*, *Uredo confluens*, *Urocystis pompholygodes*, from Packington; *Puccinia ægopodii*, from Shustoke; *Piggotia astroidea*, from Hampton-in-Arden; and *Rhytisma acerinum*, in the perfect state, from co. Antrim, Ireland. He also made some interesting remarks on the different stages in the life history of *Aspergillus glaucus*, the green mould, illustrated by specimens and drawings. After the remarks a discussion followed, in which most of the members present took part.—GEOLOGICAL SECTION, May 25. T. H. Waller, Esq., B.A., B.Sc., in the chair. A paper was read by Mr. A. T. Evans on "The Quartzite Pebbles of the Drift." Mr. Evans exhibited many beautiful specimens of fossils obtained from the Drift pebbles. Mr. Horace Pearce, of Stourbridge, exhibited fine specimens of rocks from granite quarries of Aberdeen and Peterhead, also from Aberdeen Beach. These specimens were interesting, as showing the component minerals of granite, separated out in large quantities. Mr. Walliker exhibited *Menyanthes trifoliates* (busk-bean). A vote of thanks was given to Mr. A. T. Evans and Mr. Horace Pearce.

BIRMINGHAM MICROSCOPISTS' AND NATURALISTS' UNION.—April 19th. Mr. C. F. Beale exhibited two ancient bronze celts from a gravel bed at Abingdon. They were of different kinds, one was of the winged form, the other socketed and looped; also sections of a coral from the greensand. Under the microscope Mr. Hawkes showed a fungus, *Venturia myrtilli;* Mr. J. W. Neville, specimens of *Polyxenes lagurus.* Mr. Delicate then read a paper on "Staining Vegetable Tissues." The writer described the cutting, bleaching, and washing of sections ready for staining. The following aniline dyes were recommended as very suitable—magenta, mauve, green, and blue. When the tissues are sufficiently stained the colours are fixed with acetic acid. The process of single and double staining was shown, and the objects exhibited during the evening.—May 3rd. Mr. J. Moore exhibited specimens of *Physa gyrinea*, *P. arnillina*, *Limnœa elodes*, and other freshwater shells from America; Mr. Madison, specimens of *Vertigo minutissima*, from Sheffield; Mr. Hawkes, *Empetrum nigrum* and *Vaccinium vitis-idæa*, from Sutton Park; Mr. Baker, a wren's nest built in an old hat that was used to scare away birds; also a wasp's nest built in a currant tree.—Saturday, May 8th. The members and friends visited the Lye Cross Colliery, near Dudley. The shaft, passing through 76 yards of basalt, reaches the heathen coal at a depth of 233 yards. The party was conducted through the workings by the president, Mr. C. Beale, and Mr. Latham, who pointed out various places in which the coal was charred and burnt by contact with the intrusive rocks. A portion of the workings was lighted up with coloured fire. A hearty vote of thanks to Mr. Latham and Mr. Beale brought the afternoon to a close.—May 10th. Mr. Hawkes exhibited several fungi, including *Trichobasis scillarum* and *Puccinia anemones;* Mr. A. T. Evans, pebbles from the drift, containing fossils of *Orthis Budleighensis*, and other shells. Under the microscope, Mr. Wagstaff showed *Melicerta tubicolaria*, a rare rotifer; Mr. Rodgers, sporangia of *Asplenium viride;* Mr. Mulliss, proboscis of honey bee. A paper was then read by Mr. Hawkes on "Buds, their contents and development." The writer described the various kinds of leaf and flower buds, and the manner in which they aided the fall of the leaf. The large number of aborted buds was noticed, and their effect on the form of the tree, and the appearance of the grain of the wood. The structure and contents of buds were dealt with at some length, the mode in which leaves and flowers were stowed away, the early development of the male organs, the simplicity of bud corollas, the special development of some buds, as the horse-chestnut, to suit this climate, and the large number of flower buds that never reach maturity, were remarked upon. The paper was illustrated by diagrams and a large number of sections under the microscope.

LEICESTER LITERARY AND PHILOSOPHICAL SOCIETY. —SECTION D, ZOOLOGY AND BOTANY. Chairman, F. T. Mott, F.R.G.S. Monthly Meeting, Wednesday, May 19th. Attendance thirteen (two ladies). Mr. Mott was re-elected chairman and Dr. Cooper secretary. Mr. Vice reported that the occupants of the small cocoons on the chrysanthemum leaf, which Mr. E. F. Cooper brought to the Section last month, had come out, and proved to be dipterous flies, about $\frac{1}{6}$in. long; probably a species of *Phytomyza*. The following objects were exhibited, viz.: by Mr. E. F. Cooper, F.L.S., a spadix of *Arum maculatum.* The Rev. T. A. Preston, M.A., described the arrangements in this remarkable flower for catching and detaining small insects, in order to convey the pollen to the stigmas. Upon this a discussion

arose as to the need of such an arrangement merely to secure self-fertilisation, which must almost certainly take place automatically, seeing that the anthers are just above the stigmas. Yet the reflexed hairs on the abortive flowers above the anthers seem to prevent the insects from escaping to carry the pollen to other flowers. It was suggested that the members should investigate the process individually, and report their observations. By Miss Noble, a flowering specimen of *Geum rivale*, from Burbage Wood. By the Chairman—fertile fronds of *Onoclea (Struthiopteris) germanica*, full of ripe spores, from Belvoir Castle, portions of which were distributed for cultivation, as this fine hardy fern is said to do well in gardens; also, fragments of a nodule of iron pyrites, brought to him as part of a meteorite, which was certainly a mistake. A discussion took place as to the depth to which meteorites would penetrate if they ever really struck the earth. Dr. Tomkins, as a member of the Volunteer Artillery, pointed out that the kinetic energy of such objects must be greater than that of cannon shot, and that they must bury themselves to a depth which would render a small meteorite practically irrecoverable. The Chairman suggested that the resistance of the atmosphere, especially the denser portion near the surface, would counteract and extinguish a large part of the initial velocity, and that though the accelerated velocity of a body falling from a height of say forty miles could be theoretically calculated, the formula was only correct *in vacuo*. No experiment from such a height had ever been made, and the atmospheric resistance in such a case would become a very important factor. Subjects for discussion:—1. Carnivorous plants. Mr. J. T. Thorpe exhibited a beautiful living specimen of *Pinguicula vulgaris*, in flower, in a pot, which he had had in his possession for several years. The leaves were observed to be covered with glandular papillæ, and about their incurved edges were seen the remains of several captured flies. Mr. Thorpe stated that from his own observations he found that the edges were rolled over in about twenty-four hours after the capture of an insect, and that they unrolled themselves and became flattened out again in from thirty to forty hours more. Inquiry was made as to how many British plants were known to be carnivorous. The list, as at present known, is a small one—viz., *Pinguicula vulgaris*, *Drosera* (three species), *Utricularia vulgaris*, and probably *minor* and *intermedia;* perhaps also two or three species of *Saxifraga* should be included, and further investigations may add other genera. Many plants exude viscid secretions, by which insects are caught and killed without being utilised as food by those plants. 2. Natural history diaries and note books. Rev. T. A. Preston described "The Practical Naturalist's Diary," published by Swan Sonnenschein and Co., price 2s. 6d. Several other forms of diaries and note books were also exhibited, and their merits discussed.

PETERBOROUGH NATURAL HISTORY, SCIENTIFIC, AND ARCHÆOLOGICAL SOCIETY.—April 26th. Excursion to Helpstone Heath.—April 27th. The Marchioness Dowager of Huntly threw open the grounds at Orton Hall to the members of the society. The rock and alpine plants, which were flowering in great beauty, attracted considerable attention.—April 29th. GEOLOGICAL SECTION.—President, Mr. E. Wheeler. Visit made to the Spital Cutting (Cornbrash section), but owing to the lateness of the hour no rare fossils were obtained, and arrangements were made to work the same section on May 13th.

MICRO-ORGANISMS IN A SWAMPY DITCH IN SUTTON PARK.*

BY T. BOLTON, F.R.M.S.

In a swampy ditch in Sutton Park, not more than thirty yards long and one yard wide, in which a quantity of sphagnum was growing, I have found in the course of the last six months a great variety of interesting organisms, more than a hundred in number, and including several new species.

For the identification of the desmids and diatoms I have had the assistance of Dr. Anthony and another correspondent. Dr. Hudson and Mr. Gosse have helped me as to the rotifers, and the finding in this ditch of *Notommata spicata* (described by Dr. Hudson before the Royal Microscopical Society in May last) led me to make a more systematic examination of its contents. Mr. Gosse has identified from the same source a great number of free-swimming rotifers, several being new, and others so rare that he had not seen them before.

Diatoms.

Nitzschia sigmoidea.
,, *Tænia.*
Pinnularia nobilis.
,, *major.*
,, *lata.*
,, *gibba.*
Navicula ovalis.
Stauroneis Phœnicenteron.
,, *gracilis.*
Surirella bifrons.

On the diatoms from this locality I have occasionally seen the growth of numerous filaments resembling those described by Mr. Badcock in the "Journal of the Royal Micr. Soc.," 1884, p. 352, figs. 49, 50. I believe them to be of an algoid or fungoid nature.

Desmids.

Hyalotheca dissiliens.
,, *dubia.*
Micrasterias denticulata.
,, *rotata.*
,, *ovata.*
Euastrum oblongum.
,, *crassum.*
,, *Didelta.*
,, *ansatum.*
Closterium lanceolatum.
,, *turgidum.*
,, *Ehrenbergii.*
,, *moniliferum.*
,, *Dianæ.*
,, *didymotocum.*
,, *lineatum.*
,, *striolatum.*
,, *Cornu.*

* Transactions of the Birmingham Natural History and Microscopical Society. Read February 16th, 1886.

Tetmemorus Brebissonii.
,, *granulatus.*
Penium margaritaceum.
Closterium lunula.
,, *acerosum.*
Closterium acuminatum.
,, *gracile.*
,, *parvulum.*
Spirotænia condensata.

Among the desmids *Closterium lunula* was very abundant and fine. I called Dr. Anthony's attention to the remarkably strong manifestation in this species of the circulation of the granules in the protoplasm, and we examined them together under his $\frac{1}{25}$th-inch objective. We could see two rapid currents of granules coursing down the edge of the frustules in opposite directions in very definite channels. Such rapidity and definiteness of the circulation in desmids neither of us had ever seen before. I have often seen the swarming of the desmids from this locality, especially in Micrasterias, when the whole protoplasmic contents seem to be in a boiling state. It is remarkable that no biologist has yet been able to explain satisfactorily either the circulation or the swarming.

An interesting occurrence of abnormal growth in *Closterium lunula* found in this locality is worthy of note. A very similar growth is figured by Mr. Archer in the "Quarterly Journal of Microscopical Science," 1860, pl. XI., fig. 5. I believe it is the result of a parasitical fungus, Olpidium.*

Of the other algæ I have only identified the pretty spherical *Eremosphæra viridis*, figured in Plate I. of Cooke's "British Freshwater Algæ." The different species of Oscillatoria and Spirogyra and some other filamentous algæ, often present, I have as yet not identified sufficiently to distinguish the species.

RHIZOPODA.

Amœba Proteus.
,, *verrucosa.*
,, *radiosa.*
Difflugia pyriformis.
,, *acuminata.*
,, *spiralis.*
,, *urceolata.*
,, *corona.*
Nebela coronis (or *D. lobostoma*?)
Arcella vulgaris.
Centropyxis (Arcella) aculeata.
Actinophrys sol.
Actinosphærium Eichhornii:
Acanthocystis chætophora.
Biomyxa vagans.
Euglypha sp. (empty case only).
Cyphoderia ampulla.

Of the Rhizopoda, the *Amœba Proteus* was remarkably large and fairly abundant. I would call attention to the peculiar markings on the Difflugiæ, corresponding well with

* Figured in Cooke's "British Freshwater Algæ," pl. 81, fig. 2.

the beautiful drawings in Dr. Leidy's splendid Monograph of Freshwater Rhizopods of North America. They afford very good examples for studying the question raised by Dr. Wallich in his critique on this work in the "Annals and Magazine of Natural History," Vol. XVI., 1885, as to the source of these markings, some of which are evidently dependent on the appropriation of the empty cases of diatoms; but such markings as those shown by Dr. Leidy in *Difflugia spiralis* (often present in this locality) are to me inexplicable. It is most wonderful that a minute mass of formless jelly, such as these animals apparently consist of, should have the power of building up these definitely-shaped and elaborately-adorned dwellings.

The specimens of *Acanthocystis chætophora* with its bristling bifurcate-spine-covered spheres and brilliant green contents were numerous, but of *Biomyxa vagans* I have only found two specimens, both on the same slide.

Infusoria.

Astasia trichophora.
Dinobryon sertularia.
Uvella virescens.
Hemidinium nasutum.
Euglena viridis.
Spirostomum ambiguum.
Stentor sp. (*Mülleri?*).
Vorticella campanula.
Ringed groups of Flagellate Monads.

Of the Infusoria, the ringed groups of flagellate monads form, I think, a new species. I have seen them only in this locality. They look like a ring of choano-flagellate monads; I have not been able to submit them to a power sufficient to make certain of the flagella or collars, but their active motion as they swim about, revolving on the axis of the ring, gives a fair presumption of their flagellate character. The diameter of the ring is $\frac{1}{600}$ of an inch.

Rotifers.

Rotifera:—
Floscularia ornata.
Ptygura melicerta.
Philodina aculeata.
,, *citrina.*
**Notommata spicata.*
*Two other allied species.
Furcularia forficula.
,, *gracilis.*
,, *cæca.*

* Described in Hudson and Gosse as *Copeus spicatus*, *Copeus labiatus*, and *Copeus pachyurus*. Mr. Gosse considers the first to be the largest known rotifer.

Rotifer vulgaris.
,, *tardus.*
,, *macroceros.*
,, *macrurus.*
Callidina elegans,
Polyarthra platyptera.
Pleurotrocha constricta.
Notommata forcipata.
,, *saccigera.*
,, *collaris.*
,, *decipiens.*
,, *felis.*
*Two other species.
Eosphora aurita.
Mastigocerca carinata.
Euchlanis luna.
Dinocharis tetractis.
Colurus caudatus.
,, *deflexus.*
And a new *Anuræa.*
Chætonotidæ :—
Chætonotus larus.
,, *hystrix.*

The great variety of rotifers is very remarkable. They have all been seen and identified by Mr. Gosse except *Ptygura melicerta*, which Dr. Hudson has seen. Of the new ones, *Notommata spicata* was named by Dr. Hudson ; of the others, *N. pachyura*, *N. labiata*, *Furcularia micropus*, and *F. Boltoni*, I give the names which Mr. Gosse has proposed for them, and I look with interest to see his descriptions of them in their Monograph of the Rotifera, which is now being published. Two other species, *N. saccigera* and *N. felis*, had not been previously seen by Mr. Gosse.

Tardigrada or Water-bears.

Occasionally I found some specimens of this group, which I think must be *Macrobiotus Hufelandii*, but I am not quite certain of the species. The most complete account of this group that I know of is given by M. Doyère in the "Annales des Sciences Naturelles," 1840. A translation of this memoir, with reprints of the figures, would be very welcome to pond-hunters.

Naidina.

Chætogaster diaphanus.
Nais proboscidea.
,, *hamata.*
Slavina appendiculata.
,, *lurida.*
Ælosoma quaternarium.

Professor Ray Lankester identified for me *Nais hamata ;* I have not heard of its having been found elsewhere in England. It is figured and described in my " Portfolio," No. II.

There were a few entomostraca, such as Cyclops, Cypris, and Lynceus, but I have not identified the different species.

* *Ibid.* *Furcularia Boltoni* and *Furcularia micropus.* Mr. Gosse records another new one, *Pedetes saltator*, allied to *Triarthra*, but with only two styles instead of three.

NOTES OF AN AMERICAN TOUR.

BY W. P. MARSHALL, M.I.C.E.

(*Continued from page 150.*)

In St. Louis city, visited next, a singular sight was witnessed, illustrating the primitive nature of the original construction of the town; the principal street was under repair for repaving and lowering a portion to make it level, and get a good foundation. Half the width of the roadway was closed for the purpose, and there was a two-horse plough at work ploughing up that portion and turning up original field soil; the original ground having been simply covered with rough concrete for laying stone blocks, and just laid on the surface of the field in making the primitive road of the young settlement.

Then came a long railway ride of two days and nights continuously across Kansas State into the heart of the Rocky Mountains in Colorado. The railway crossing the open prairie of Kansas is an extraordinary sight, a nearly level plain of grass to the extreme horizon, like a view at sea, without a single object in sight sometimes, not a fence nor a hedge or tree, nor any trace of animal life except stray skeletons and horned skulls. The railway is carried straight across the prairie, on the surface of the ground, without any fence or ditch, and only a row of telegraph poles to be seen running alongside. The prairie on fire was seen one night, a grand sight; the fire was a long way off, near the horizon, but there was a grand effect of flame and smoke.

Breakfast was served next morning in the train, served just as at an American hotel, at a number of little tables for four persons each, ranged down both sides of a Pullman dining car. The dining car was shunted at the next station to another train going back in the opposite direction, for giving the passengers breakfast in that train also, there being no refreshment station within half a day's distance.

The comical little prairie dogs (a kind of marmot) were seen in quantities scampering about alongside the railway, often standing up like rabbits squatting on their hind legs on the top of their hillocks in amusing attitudes, and then suddenly plunging head foremost into their burrows. They

are something like small light-brown rabbits, but give a sharp little bark like a dog, and on that account have the name of prairie dogs.

An adventure at one station in this part gave an amusing picture of American travelling in this thinly populated prairie country. A carriage was seen driving across the open prairie towards the station at which the train had stopped, but still at a great distance; and some passengers in the train told the conductor they were sure it was someone known to them who was wanting to catch the train (it must be remembered there is only one through passenger train per day on the line). The train was actually kept a quarter of an hour stopping for the purpose, when up drove a carriage and pair of horses, and out jumped a gentleman and lady and caught the train before it was started; they told us they had driven twenty-five miles in $2\frac{1}{4}$ hours across the open prairie to catch the train, and were going on to California. There was hardly anyone else to get in or out of the train at the station, and the town consisted of little more than a dozen houses or huts, without an object in view but some cattle, to the extreme horizon, except some very distant mountain outlines with snow caps.

The first sight of snow mountains was Pikes Peak, which is 14,000 feet high, and was seen from Las Animas Station, at about 150 miles distance. The clearness of the air was wonderful; the mountains looked only twenty or thirty miles distant, so bright and clearly defined with the snow seen lying upon them, and the light and shade of the cliffs. Such lovely perfection of atmosphere and weather, glorious bright warm sunshine, and light summer clouds with beautiful effects of brilliant light and colour, and the whole tempered by soft cool breezes from the great elevation of the prairie, which is 5,000 to 6,000 feet above sea level. Then getting into the Rocky Mountain district, at Alamosa, the level is 7,000 feet above sea, and there the railway is carried over the great La Veta Pass 9,000 feet above the sea, and afterwards passed near the grand snow-capped mountains, "Spanish Peaks,' which are 13,000 feet high (as much as the Jungfrau and its neighbours); lovely objects they were, two grand peaks of dazzling whiteness with their snow caps standing out in the clear atmosphere, so that the cliffs and ravines could be plainly distinguished, though about twenty miles distant. This atmosphere is the great charm of the country, so exhilarating and free; it seems another sensation of life altogether.

The La Veta Pass through one range of the Rocky Mountains is a remarkable work with long sharp curves, that double on themselves in the zigzag ascent up the steep side of the valley, and pass so near in each course that a stone could almost be thrown from one to another of three trains on lines one above another, and more than four miles of line are run over to make an advance of only half a mile. There is a continuous ascent of fourteen miles at a gradient generally as steep as one in twenty-five, and then a similar descent of as great length on the other side of the pass. This railway through the Rocky Mountain district is the narrow gauge of three feet.

Manitou, a valley in the Rocky Mountains in Colorado, is a favourite place for visiting from all parts of the States, and was stayed at for several days; it is at the foot of Pikes Peak, and is itself 6,000 feet above the sea, and the grand Pikes Peak towering above with its lovely snow cap, at 14,000 feet height (within 1,000 feet of the height of Mont Blanc). In the neighbourhood of Manitou are the Garden of the Gods and Monument Park, two very interesting and remarkable collections of strange fantastic rocks that are quite fascinating from their extraordinary forms and picturesque variety of colour, and of great extent. These rocks are sandstone of different degrees of hardness, and varying in colour from light grey to dark red; the caps are portions of a harder stratum above the softer one below, which has consequently worn away faster, but the difference in hardness is only little, and both are in a friable condition. There are also in the Garden of the Gods great irregular masses of sandstone rock, standing up on edge, and reaching to more than 300 feet height.

The ascent of Pikes Peak from Manitou was a grand adventure, taking eleven hours, and gave charming views of the other distant snow peaks of the Rocky Mountains, and the immense extent of distant plains; and the view, on descending in the evening sunlight, of the strange picturesque rocks in the Garden of the Gods at the foot of the mountain was most fascinating, from the brilliant colours shown by the different rocks in the bright sunshine. There was a complete garden of flowers extending through the valley and far up the mountain.

Pueblo was then visited, an old Mexican town at about the latitude of Algiers, giving a very interesting and picturesque effect in the brilliant sunshine. Many of the houses are built of sun-dried bricks made of mud and straw, called "adobés," which is the native building material. Adobé

houses, as they are called, are scattered about over a large tract of the country; the bricks are about eighteen inches long, nine inches wide, and three and a half inches thick, and are stuck together with mud for mortar, and plastered over with smooth mud, and the flat roofs are made with poles laid flat across the top of the walls and plastered over with mud. Many modern houses of this make are built with regular wood-framed doors and windows, and they are universally preferred by the native population of mixed Mexican breed. A number of Indians were seen swarming about the train at the stations in the open country, bringing curiosities for sale.

Then we stopped at Santa Fé, in New Mexico, the oldest town in the United States, where a fine collection was seen of interesting and unique Mexican relics, including an agate spearhead as large as $6\frac{1}{4}$ inches long and $4\frac{1}{4}$ inches wide, said to be the largest known, and stone axe-heads with three grooves round them for the binding on the handle, considered to be unique. The place was most delightful from the soft clear air and brilliant sunshine, at an elevation of 7,000 feet above the sea.

From there the journey was all day across a great level plain, bounded by lovely blue mountains on each side at twenty to fifty miles distance, the plain being 4,000 feet high above the sea, in some parts green with shrubs and dwarf trees, but more generally bearing nothing but isolated cactus plants and tufts of the sharp-pointed "Mexican dagger plant," a kind of aloe *(Yucca angustifolia)*, the root of which is used as soap in the district.

One long portion of the country was an absolute desert of sand, without any object visible but the distant mountains, and we saw there, in passing, a real desert *mirage;* the blue hills about fifty miles off at the extreme horizon appeared lifted up in the air, with an inverted reflection of them below and a narrow streak of apparent water in front. This had the exact appearance of a great lake, with the reflection of the hills in the water; the whole so perfectly natural when examined with an opera glass, that it seemed impossible for it not to be real. The scene remained visible without alteration for a long time whilst passing in the train. The sun was blazing hot, with an almost cloudless sky, but there was a delightful soft cool fresh air that made the weather perfectly delicious.

Benson, in Arizona, on the Mexican frontier, was the most southerly point visited (about the latitude of Alexandria). The great charm of the country was the "desert garden;"

the whole plain, as far as the eye could reach, was covered with gigantic plants of cactus, yuccas, and aloes, grand yuccas with splendid spikes of flowers standing 20 feet high or more, and enormous dead stems 30 feet high and 1 foot to 1½ feet diameter, presenting most strange and uncouth shapes. Cactus plants in great numbers, some globular, as large as a small barrel, just bursting into bud all over, others flat-leaved, in patches as large as a dining table, with leaves as big as small plates; and cactus trees standing up like weird giants, one 10 feet high and 19 inches diameter, bursting into bud (in the garden of a station open to the platform), and another as high with a bunch of lovely white flowers at the top, each as large as a wine glass. Still larger plants were seen afterwards on the plain in passing by the train, with great vertical side branches. Large quantities of beautiful flowers were seen, and while stopping at stations we just stepped off the carriage platform to pick escholtzias and gallardias and others of our favourite garden flowers growing wild in abundance and in rich flower. The train, approaching Los Angeles on the Pacific coast, gradually descends from the high table land to the sea level, and at one point, at 150 miles from the coast, actually drops 260 feet below sea level on passing across a great depressed sandy track, probably an old lake bottom now dried up; for sixty miles length the line is below sea level. Eighty miles before Los Angeles in South California we passed through a remarkably fertile corn-growing valley; a fine wheatfield, 1½ miles long and more than half-a-mile wide, continuous without a single fence or break, and joining on to continuous barley crops at each end, extending altogether as long as half-a-dozen miles. Large tracks of the barley were cut and being carried (at the end of May), and the wheat was nearly ready for cutting. Barley is grown very extensively in Western America as horse food, instead of oats, which are little used; barley is found the more suitable food for the sturdy half Mexican horses that are used in the mountainous districts for coach traffic, where the time of each run is very long on account of the very hilly roads, although the distances are not great.

The new American reaping machine was seen at work, by which the corn is not only reaped, but is also threshed, winnowed, and sacked, all continuously in the same machine, avoiding the extra labour and the loss arising from subsequent handling of the grain. The corn is cut close below the ear, and the straw left on the ground The machine is followed in the field by waggons, which are loaded with the sacks of grain that are delivered by the reaping machine ready filled,

weighed, and tied. Such a process is, of course, only possible in a very dry country, where the grain is ready for threshing when cut.

Los Angeles, near the Pacific coast, and within 300 feet of sea level, is in a real southern climate, with only about 12° variation in average monthly temperature throughout the year, 55° average for January, and 67° average for July. It is the special orange country, and a charming drive to Sierra Madre, fifteen miles out, was mostly through orange orchards, with the trees loaded with fruit, lemon and lime orchards, and miles of grape vineyards (dwarf plants like the Rhine vineyards). Oranges picked up off the ground like dropped apples, and orange orchards open to the road like apple orchards; and a beautiful display of wild flowers all the way, including many of our favourite Californian garden plants growing wild in abundance and in luxuriant bloom.

There are a number of large private houses with beautiful gardens extending several miles round Los Angeles, which is a favourite place for residence; and a great treat is the sight of the luxuriant semi-tropical plants and shrubs and rich masses of flowers, rich creepers over the houses covered with blossom, banana trees in fruit, and pomegranate and pepper trees grown as ornamental shrubs, the pomegranate covered with magnificent deep crimson flowers, and the pepper trees with elegant bunches of bright red berries, that turn black when the pepper is ripe. A great aloe was seen in full bud, thirty feet high, with a flower panicle twelve feet long, and the bottom leaves six feet long and seven inches wide.

A curious circumstance noticed from having travelled so far south was that instead of the days getting longer with the advance of summer they stood still or actually got shorter as the journey proceeded. The sun was set by seven o'clock at the end of May, and if we had gone as far as the Equator we should have seen him setting and rising at six o'clock, the same all the year round. The sun was so nearly vertical over head that the south could not be ascertained from his position, and the only way was to turn round until the shadow of your head when standing upright fell just between your toes, and then you knew that you were facing the north.

(To be continued.)

THE MONUMENTAL BRASSES OF WARWICKSHIRE.

BY E. W. BADGER, M.A.

(Continued from page 160.)

HASELEY.—*Clement Throkmorton, Esq.*, 1573, *and w. Kath., with* 6 *sons and* 7 *daus. Haines.*

Upon an altar-tomb in the chancel is this interesting memorial, part of which is palimpsest. This word is more properly applied to a M.S. in which the first writing has been defaced to make room for later matter; but the term palimpsest is also applied to (1) brasses engraved anew upon the reverse side of the original; (2) those altered to suit another name and date; (3) unaltered effigies with new inscriptions. The present brass is an example of the first kind; part of the inscription has lines of drapery on its reverse side; and the group of sons is upon a plate bearing some beautiful architectural details. These portions have lately been fitted with hinges, so that both sides may be examined.

The effigies of the knight and his lady are 2ft. 3in. and 2ft. 1in. long respectively. The former is recumbent, his head resting upon a tilting-helmet; but his feet are inconsistently represented as standing amongst grass and flowers. His armour is chiefly of plate, but he wears a hauberk of mail; and there are ruffs round his neck and wrists. There is no need to describe the armour in detail, but reference may be made to the two *tuilles* over the thighs, the broad *sabbatons* on the feet, and the rivets which fasten the plates together. The lady, who is at the knight's left side (armorially speaking, her proper position), wears a Paris hood, and a gown with out-standing collar, and tight sleeves puffed at the shoulders. Beneath this is another dress, with profusely embroidered skirt. Ruffs are seen at the neck and wrists; and from the waist-band, attached to a long ribbon, hangs a book with two clasps. Below the knight are six sons, in long gowns and doublets; and opposite to them are seven daughters, dressed like their mother. Above the parents are two shields and a lozenge. The centre shield bears THROKMORTON, with quarterings of ABERBURY, OLNEY, SPINEY, ——, and WIKE. The lozenge, which has been relaid upside down, of course bears the lady's arms, NEVELL, and the shield on the left shows the husband's arms (already described) impaling the wife's. At the bottom of the tombstone are two shields like those already described.

The inscription is :—

✠ Here lieth the bodye of Clement Throkmorton Esquier the thirde | Sonne of Sr George Throkmorton Knight, and Katherin Nevell his wyffe the ffirste and eldeste Daughter of Sr Edward Nevell Knight, of whom he begate syxe sonnes and seven | Daugters, he departed this world the sondaye beinge the xiiiith of | December in the yere of our lorde God MCCCCC seventye and three and in the syxtene yere of the raigne of our most Gracious and sufferaigne ladye quene Elizabeth.

The Sir George Throkmorton referred to is the knight whose effigy is at Coughton (see above). Dugdale gives an illustration of this brass.

HILLMORTON.—*A lady, circ.* 1410. *Haines.*

This fine effigy, 4ft. 6in. long, is very similar to the brass at Merevale. It is underneath the floor of a pew in the south aisle of the church, and is in fairly good preservation. The lady is clad in a close-fitting kirtle, with sleeves reaching to the knuckles. Over the kirtle is a mantle drawn together by a cord. The head-dress is that known as the *crespine* (see Merevale), with which is worn a graceful kerchief. At the lady's feet are two small lap-dogs. From her hands proceeds a scroll, part of which, containing the angel's salutation to S. Mary the Virgin, is lost. The following words are left :—

Ave . . . . fruct' ventris tui. Jhū fili dei miserere mei.

That is in English :—

Hail . . . . fruit of thy womb. Jesu son of God have mercy on me.

There is no other inscription left; on either side of the effigy is the matrix of a small shield.

Dugdale records "two gravestones of marble having small portraictures in brass," a description which does not suit this example.

IPSLEY.—There are no brasses at Ipsley, as Haines states, but two incised slabs.

ITCHINGTON, LONG.—*John Bosworth, yeoman,* 1674, *and ws. Haines.*

A large plate, about 2ft. 2in. square, set in a stone tablet with pillars, mouldings, &c. At the top of the plate is the figure of a man in a long belted doublet, kneeling upon a

cushion. The letters I B are engraved near his head. Upon his right side is depicted a lady kneeling upon a cushion and holding a book. She wears a cap with acutely pointed sides, a bodice, skirt, and apron. The name ELLINOR is inscribed near her. On the opposite side kneels a similar figure, with the name ISABELLA. At the bottom of the brass on the left is a skull and cross-bones, and on the right an hour-glass and cross-bones. The drawing is poor, and the spirit and style of the whole composition is debased. The following inscription is beneath the figures:—

BEHOLD THE CHARITY OF JOHN BOSWORTH OF YARDLEY IN THE COVNTY | OF WORCESTER YEOMAN HE DEPARTED THIS LIFE THE XTH OF MARCH 167$\frac{4}{5}$ | IN THE LXXXII^{D} YEARE OF HIS AGE HE GAVE BY HIS LAST WILL AND TESTAMENT | VNTO DIVERS TRVSTEES FOR THE VSE AND BENEFIT OF THE POORE OF | THE PARISH OF LONG ITCHINGTON IN THE COVNTY OF WARWICK AND | THEYR SVCCESSORS THE SVMME OF XV^{L} IIII^{S} YEARLY EOR EVER TO BE | PAYD AND ISSVED OVT OF ONE MESSVAGE CALLED BY THE NAME OF | BROWNE SCITVATE LYING IN BICNILL ALIAS BICKINHVLL IN THE COVNTY | OF WARWICK AND ALSOE ONE CLOSE OF LAND IN V PARTS COMMONLY | KNOWNE BY THE NAME OF WADDICE AND ALSOE ONE LITTLE CRAFT | CALLED BROAD CRAFT AND ALLSOE IIII RVDGES OF ARRABLE LAND IN | A COMMON FEILD CALLED EWETREE FEILD LYING IN YARDLEY IN THE | COVNTY OF WORCESTER VIZ V^{L} IIII^{S} TO BE BESTOWED IN XII TWOPENNY | WHEATEN LOAVES EVERY SABBATH OR LORDS DAY TO BE SETT ON THE | COMMVNION TABLE AND TO BE DISTRIBVTED BY THE CHVRCHWARDENS | AND OVERSEERS OF THE POORE VNTO XII OF THE POOREST OF THIS PARISH | VIZ THE OTHER X^{L} TO BE BESTOWED FOR THE MAINTAYNANCE OF A GOOD & | ABLE SCHOOLMASTER TO TEACH THE POORE OF THIS PARISH SONNES AND | DAVGHTERS TO READ THE GRAMMER & OTHER LITERATVRE & ALLSOE TO WRITE | & CAST ACCOMPT AS IN MY WILL IS MORE AT LARGE EXPRESSED |

ALL YOV THAT PASSE MEE BY
AS YOV ARE NOW SOE ONCE WAS I
AS I AM NOW SOE SHALL YOV BEE
REMEMBER THE POORE & IMITATE MEE

MEREVALE.—*Robt. Lord Ferrers of Chartley* 1412(?), *and w. Margt.* [*Spencer.*] *Haines.*

These magnificent effigies lie upon the floor of the chancel. The knight is 5ft. 2in. high, and is clad in the plate-armour of the early part of the fifteenth century, viz.: bascinet, gorget (instead of the mail camail), epaulières, brassarts fastened with straps, coutes, vambraces, gauntlets showing the finger-tips and armed with gadlings, cuisses, genouillières,

jambs, sollerets, and rowelled spurs. At the armpits are circular plates called *roundels*, which served to cover the joints of the harness. The breast-plate has a skirt of seven overlapping *taces*, to the lowermost of which at its centre are fastened three smaller plates forming the *baguette*. Below this skirt is a row of rings, every third ring having another depending from it. This edging of mail may be part of a mail shirt, but is probably merely a survival in the shape of a fringe. The knight's sword has a straight cross-guard (part of which is lost) and is fastened to an ornamental belt, arranged diagonally across the hips. Part of a dagger remains at the left side, and the scabbards of this and the sword are ornamented with the usual rows of *guttès* or drops. The knight's head rested upon a tilting-helmet, which is lost; the *panache* of peacock's feathers which adorn it is, however, in good preservation. At the feet of the effigy is an animal resembling a bear. The lady's effigy measures 5ft., and is at the knight's left hand, the head resting on two cushions. She wears the *crespine* head-dress, which confined the hair in a net, and formed two small bunches over the ears, the whole being kept in place by a band encircling the head. Over this is thrown a kerchief. The rest of the costume is a long mantle fastened across the chest by a cord, and a tightly-fitting kirtle, with tight sleeves reaching to the knuckles and buttoned beneath the forearm with eighteen buttons. A small dog, with a collar of bells, is at the lady's feet.

There is neither inscription nor canopy, and as the brasses, both of which have been broken, have been relaid in a new stone, there are no matrices. Haines refers to illustrations of this brass in Gresley's Forest of Arden, and Boutell's Series. Gresley seems to suppose that the knight's effigy represents Robert Earl Ferrers, who founded the Abbey of Merevale in 1148, and was there buried in an ox-hide, a most improbable supposition.

MERIDEN. *Elizth. Rotton*, 1638, *with anagram. Haines.*

An effigy, 2ft. 4in. long, representing a young lady of very comely appearance. She wears a cap with escalloped edges, beneath which her hair hangs in graceful curls. Her bodice, which is tied at the waist with a ribbon, has a double falling-collar and double cuffs, both with escalloped edges. The upper parts of the sleeves have lappets caught up above the elbow and tied with a bow. The skirt of the dress is plain, and short enough to reveal a pair of high-heeled shoes with rosettes in front.

On a plate, 2ft. 4in. by 1ft. 4in., below the figure is this inscription, with an anagram upon the lady's name, *i.e.*, a re-arrangement of the letters of her name in the form of a motto:—

Memoriae Sacrum
SVB ISTO LAPIDE MARMOREO PLACIDE RECVMBIT ELIZABETHA ROTTON, SINGVLARIS FORMÆ AC VIRTVTIS VIRGO FILIA ET HÆRES THOMÆ ROTTON GENEROSI, ET MARGARETÆ VXORIS EIVS, QVÆ IN FLORIDA (HEV) IVUENTVTE EX HAC VITA MIGRAVIT 14° DIE DECEMBRIS A° ÆTATIS SVÆ 20 ET SALVTIS NRÆ 1638
The Text at her Funerall.
Math. 9, 24. The maide is not dead but sleepeth.
Anagr. { Elizabeth Rotton / I to A blest Throne. }

FREINDS WEEPE NOE MORE: WHEN THIS NIGHTS SLEEPE IS GONE
I SHALL A RISE, AND GOE TO A BLEST THRONE.

Translation of the Latin:—

Sacred to memory.

Beneath this marble stone peacefully rests Elizabeth Rotton, a maid of rare beauty and virtue, the daughter and heiress of Thomas Rotton, gent., and of Margaret his wife; who in the bloom (alas) of her youth departed out of this life on the 14th of December in the 20th year of her age, and in that of our salvation 1638.

(To be continued.)

THE PRINCIPLES OF BIOLOGY.*

BY HERBERT SPENCER.

PART III., "THE EVOLUTION OF LIFE."

BY C. H. ALLISON.

CHAPTER XIII., "THE CO-OPERATION OF THE FACTORS."

To more fully show that the truths of animal and vegetal development are expressible as manifestations of the abstract truths postulated in *First Principles*, the processes separately described in the four preceding chapters are in this chapter contemplated in their *ensemble*.

* Transactions of the Birmingham Natural History and Microscopical Society. Read June 25th, 1885.

We find that change of structure is always due to change of incident forces, and that for organic evolution there is sufficient cause in the continual changes in environments; and further that, conforming to the law of "the instability of the homogeneous," there has been continual differentiation among individuals and aggregates of individuals, of which those only whose internal actions have been but slightly incongruous with external actions have survived. But survival through changes of conditions implies adjustment to the new conditions, and this is inductively verified, for adaptation is expressible in mechanical terms as direct equilibration, and natural selection is similarly expressible as indirect equilibration.

In the earliest times, changes in external inorganic forces were the only causes of the successive modifications of organisms; but whilst these must always continue to operate, the actions of organisms on each other have become ever increasing sources of such modifications, until in man they are the chief factors.

As regards the internal processes of change entailed by these external causes, there always has been and will be a survival of the fittest; but whilst natural selection (indirect equilibration) has been and remains the only process among lower organisms, there grows with the evolution of organisms —having some activity—a direct equilibration or adaptation which plays an increasingly important part, until finally, among civilised human races, it becomes the main factor, social arrangements even tending to prevent the survival of the fittest.

Chapter XIV., "The Convergence of the Evidences."

For the doctrine of "The Evolution of Life," three classes of evidence have been assigned, of which the *à priori* were partly negative and partly positive.

The Special-Creation-Hypothesis was found to be worthless, but the more the Evolution-Hypothesis was considered the clearer its truth became, and this grew even more indubitable when the two hypotheses were confronted with the general truths established by naturalists. These inductive evidences occupied four chapters, embracing the arguments from Classification, Embryology, Morphology, and Distribution (in space and time), each of which groups contained arguments pointing to the same conclusion, and, moreover, the conclusion to be inferred from the arguments of any one group is the same as that to be inferred from the arguments of all the other groups, thus giving to the induction a very high degree of probability.

But deduction brings us to a conclusion in harmony with that inductively reached, for all organisms are continually passing into new environments, which, if they (the organisms) are to survive, must be met, as individuals, by re-adjusted balance of functions and correlative adaptation of structure, and as species by natural selection or survival of the fittest.

Thus we see that organic evolution conforms to the universal laws of the redistribution of matter and motion conformed to by evolution in general.

Yet, strong as is the evidence presented by the organic world as a whole of the evolution of organisms, we shall see it is greatly strengthened when we come to consider "the *ensemble* of vital phenomena presented by each organism."

Appendix to Vol. I.

The Appendix consists of a letter written in 1868 for publication in *The North American Review*, but declined by the editor in pursuance of a general rule. The subject matter is of such vast importance, as elucidating some of the most recondite portions of *The Principles of Biology*, as replying to certain serious and able criticisms, and as demonstrating that the evolution of the organic from the inorganic is a necessary deduction from *First Principles*, that it is deeply to be regretted that the necessary limitation of space renders an adequate exposition of it impossible. In the preface to the system it was explained that on account of the largeness of the projected work, the author decided to omit the two chapters on Inorganic Evolution which would otherwise have preceded *The Principles of Biology*, and this necessary though regrettable hiatus appears to have led some critics to suppose that Mr. Spencer believed in spontaneous generation instead of in generation by evolution. The way in which this latter process has operated in accordance with the great fundamental laws of the instability of the homogeneous and of the persistence of force, by the continual compounding and re-compounding of the elementary atoms, and then of the resulting Complex Molecules, until after the lapse of vast periods of time such a substance as protein comes into existence, from which still further modifications upon modifications at length evolved the lowest living forms, which at first without organs afterwards attain these attributes, is explained with an amplitude of scientific illustration and minuteness of detail requiring for its due comprehension the most careful study. It is here only possible to thus briefly indicate the nature of the propositions and the lines of argument followed in their demonstration.

MIDLAND UNION OF NATURAL HISTORY SOCIETIES.

NINTH ANNUAL MEETING, SHREWSBURY, 1886.

The Ninth Annual Meeting was held in the Music Hall, Shrewsbury, on Tuesday, June 22, 1886. The Rev. J. D. La Touche (President of the Union) occupied the chair, and among those present were—Rev. O. M. Feilden and the Rev. T. Auden (local secretaries), the Rev. Canon Butler, Rev. C. H. Drinkwater, Rev. N. Cooper, Rev. W. Houghton, Rev. W. H. Fletcher, Colonel Barnes, and Messrs. W. Phillips, R. W. Ralph, W. Beacall, W. Southam, H. Wilson (Malvern), Egbert de Hamel (Tamworth), F. W. Richards (Birmingham), E. Wheeler (Peterborough), Rev. D. P. Lewis, &c.

The Minutes of the last Meeting held at Birmingham were read by the Rev. T. Auden, who apologised for the unavoidable absence of Mr. T. H. Waller, B.A., B.Sc., Birmingham (Union Secretary).

PRESIDENTIAL ADDRESS.

The President said before reading the address he wished to say a few words of welcome to the delegates of the various towns represented. He was pleased to say that among naturalists there existed a sort of Freemasonry, and they were always glad to meet one another; therefore it did not require many words from him to express the feeling of pleasure entertained by the members of the Shropshire Society towards the visitors belonging to the Union. He wished very much that it had fallen to the lot of some gentleman more able and more eloquent than himself to welcome the delegates. It was a source of great regret to all concerned that some of those gentlemen more intimately acquainted with the town of Shrewsbury, and especially the Mayor of the borough, were not able to be present. He had received a letter from Mr. Southam, who said he was exceedingly sorry that he was unable to attend the gathering, to which he had looked forward as one of the principal events occurring during his term of office; but having been invited to London by the Lord Mayor to attend, in his official capacity, the laying of memorial stones and other ceremonials, he thought it only right that an ancient borough like Shrewsbury should be represented. In welcoming the Union, he (the President) would say that the county of Shropshire was rich in many respects, and especially to geologists, for it was by the geology of Shropshire that the geology of many other parts of the world was deciphered. It was also a country full of interest to the botanist, and therefore those gentlemen who had come from a distance would have ample opportunities for prosecuting their studies; but he was afraid the

short time they would spend among the hills and valleys would give them only a very inadequate idea of the treasures concealed beneath. He hoped, however, they would be able to reap some benefit from their visit. The work done by these Field Clubs was very considerable when taken together, but it might be very much more than it was. There was a feeling abroad that the interest in Field Clubs was declining, but if this were so he hoped that that would soon pass away. Certainly on the establishment of clubs of this sort there was a great deal of interest shown; but like all new institutions it gradually diminished, perhaps to rise again with greater energy. He knew there was a great desire among the more eminent scientific men belonging to the British Association, who recognised the work done by Field Clubs, to attend the general meeting of the clubs, and help to stimulate the love for science. He mentioned this because the delegates from a distance might perhaps make an effort to keep up the interest in the different clubs. Before proceeding with his address there was one other subject to which he would allude. He thought on this occasion, when many eminent men, interested in science, from all parts of England are gathered together, they might consider a matter which would be not only an honour to the town of Shrewsbury itself, but the whole county, and that was some greater recognition of Charles Darwin. It was an old saying that a prophet was not so much appreciated in his own country as he was elsewhere. He did not mean to say that the citizens of Shrewsbury were unmindful of the great honour conferred upon them in Darwin being born in the town, and connected with it for many years; but he did think Darwin was not appreciated as he ought to be, and if before the meeting separated the members would give an expression of opinion as to whether they approved of the suggestion he had ventured to throw out, he thought it might be the means of starting a subscription list for the purpose of erecting a statue, or adopting some other mode of recognising the life of the great and illustrious Darwin. The reverend gentleman outlined his presidential address as follows:—I propose, in the address which I have the honour to deliver on this occasion, first to recapitulate briefly the subjects which have occupied the attention of the Naturalist Societies of this Union during the past year; secondly, to enumerate the various points of interest which this county and neighbourhood afford; and lastly, to allude to the labours of Charles Darwin, that illustrious man of whose connection with the town of Shrewsbury, by birth and family, its inhabitants may feel justly proud.

Canon Butler moved that the thanks of the Meeting be given to the President for his admirable address. He announced that he had been asked to express, on behalf of the Mayor and Corporation of the town, their sense of pleasure at the visit of the Union.

Mr. H. Wilson seconded the vote, which was unanimously carried.

The Rev. T. Auden then detailed the proceedings of the Meeting of the Council held that morning and explained their report which was now presented. At that Meeting Mr. E. de Hamel had been re-elected

treasurer, and Mr. T. H. Waller, the general secretary, had been asked to again undertake the duties of that office, he having expressed a wish to resign.

Mr. W. Phillips proposed that the proceedings of the Council Meeting be approved and adopted by the General Meeting. Mr. J. Calcott seconded the resolution and it was carried.

Mr. R. W. Ralph moved a vote of thanks to the president and officers for their services during the past year. Mr. Houghton seconded it, and it was carried.

Mr. E. de Hamel proposed on his own behalf, and that of the other visitors, their hearty thanks for the excellence of the arrangements made by the local officers for that meeting. He well knew what trouble had to be taken to get up a two days' entertainment such as that, and he could fully appreciate all that had been done.

Mr. Wheeler seconded the resolution and it was carried.

Mr. H. Wilson proposed a vote of thanks to the president for his valuable services. This was duly seconded and carried unanimously.

The following is the

REPORT OF THE COUNCIL.

Societies in the Union.

During the past year two Societies have withdrawn from the Union, viz., the Bedfordshire Natural History and Field Club and the Nottingham Naturalists' Society. The list of component Societies will therefore now stand as follows :—

Birmingham Microscopists' and Naturalists' Union.
Birmingham Natural History and Microscopical Society.
Birmingham Philosophical Society.
Birmingham and Midland Institute Scientific Society.
Birmingham School Natural History Society.
Caradoc Field Club.
Dudley and Midland Geological and Scientific Society and Field Club.
Evesham Field Naturalists' Club.
Leicester Literary and Philosophical Society.
Northamptonshire Natural History Society.
Nottingham Working Men's Naturalists' Society.
Oswestry and Welshpool Naturalists' Field Club.
Peterborough Natural History and Scientific Society.
Rugby School Natural History Society.
Severn Valley Naturalists' Field Club.
Tamworth Natural History, Geological, and Antiquarian Society.

The Council views with great concern the continued withdrawal of Societies from the Union, and feels that the apparent failure of the Union to meet the expectations of so many of the original constituent Societies demands very careful attention from the members, in order to determine the causes and to devise means for more efficient mutual help and intercourse. At present the sole function of the Union appears to be that it is the excuse for a pleasant meeting and pic-nic, and with these—as the only result—the expenditure of time and money involved appears decidedly out of due proportion. The Council believes that the time has come when the Societies still remaining in

the Union, 16 out of about 30 which have at one time or another belonged to it, should definitely consider whether there is any feasible scheme by which the bond of connection now existing in the Union may be strengthened and still further utilised.

"Midland Naturalist."

The monthly issue of the "Midland Naturalist" has continued, and the character of the papers contributed has, we believe, been as high as in any former year. We have again to thank the editors, Messrs. W. J. Harrison and E. W. Badger, for their valuable services and the labour and energy they have given to the work; and the Birmingham Natural History Society for the illustrations which have added so much to the interest of several of the articles.

Since the last meeting, the conclusion of the list of the Flora of Warwickshire, by Mr. J. E. Bagnall, A.L.S., has appeared. We feel that the Union is to be congratulated on the completion of this very excellent piece of work, the outcome of the unwearied personal observations of many years, supplemented by diligent research into previous records. Among the principal articles published we may mention:—

Pennatulida and the Mode of Automatic Section Cutting and Mounting, by W. P. Marshall, M.I.C.E.; Leicestershire Forms of Capsella Bursa Pastoris, by F. T. Mott; Geological Structure of the Titterstone Clee Hill, by the Rev. J. D. La Touche; The Ear and Hearing, by W. B. Abel, B.A., F.R.M.S.; The Middle Lias of Northamptonshire, by B. Thompson, F.G.S., F.C.S.; Some Recent Observations on the Structure of Rowley Rag, by Thos. H. Waller, B.A., B.Sc.; On Starch. by Edward Francis, F.C.S.; Niagara and its Physical and Geological Conditions, by W. P. Marshall, M.I.C.E.; Notes on the Flora of America. by W. H. Wilkinson; Anthropology, by Joseph Smith, jun., M.A.I.; Some Inaccuracies upon the Geological Survey Maps and Section of the Leicestershire Coalfield, by W. S. Gresley, F.G.S.; The Occurrence of Fossiliferous Hæmatite Nodules in the Permian Breccias in Leicestershire, by W. S. Gresley, F.G.S.; The Monumental Brasses of Warwickshire, by E. W. Badger, M.A.; Notes on the Anker Valley and its Flora, by J. E. Bagnall, A.L.S.; Notes on the River Rea and the Flora of the Rea Valley, by the Rev. H. Boyden, B.A.; The Precarboniferous Floor of the Midlands, by W. J. Harrison, F.G.S.

Darwin Medal.

The subject of the present year is Zoology, and the following gentlemen kindly undertook the office of Adjudicators, viz.:—Professor T. W. Bridge, Professor A. M. Marshall, Sir Hereward Wake, Bart., and Rev. W. Houghton.

The Council regrets that the Adjudicators have unanimously expressed the judgment that none of the papers or sets of papers were deserving of the distinction of the medal. The Council, therefore, in accordance with the rule, has made no award of the medal for this year.

The Council, at the last meeting, referred the regulations for the medal to the Executive Committee for their consideration, with the view of removing some ambiguities which appeared in the existing rules. The result of the Committee's consideration was the adoption of the modified rules published in the "Midland Naturalist" in December, 1885, by which the whole set of papers, by one author, is to be considered as the competing matter, and not any one individual paper; together with an instruction to the Council to withhold the

medal in any year when, as unfortunately in this, the majority of the Adjudicators decide that none of the papers sent in are of sufficient merit to warrant the award of the medal.

The Committee appointed at the Birmingham meeting to bring the appeal as to the destruction of wild plants before the public took considerable pains to do the work entrusted to them effectually. They obtained the insertion of the appeal in many of the leading journals of the country, and articles were also published in several of them, drawing attention to and enforcing the appeal. It was also circulated extensively among the leading Natural History and other Societies of the country, and in many instances promises were sent in reply that these would do all in their power still further to spread the appeal and to carry out the suggestions contained in it.

The Council feels that the Committee deserve the hearty thanks of the Union for the thorough and painstaking way in which they have conducted the work, and hopes that as time goes on we may see the result of their labour in an increased abundance of the rarer plants of our country.

In conclusion, the Council, while regretting the apathy as regards the Union of so many of the members, feels that the circumstances of many of the component Societies are at present exceptionally difficult, and that it is only by the efforts of those who can bring to the task the necessary energy, and can devote to it the necessary time and attention, that the Union can be preserved for better times.

THE CONVERSAZIONE.

The Conversazione was held in the large room of the Music Hall on Tuesday evening, when there was a large company present, including delegates from Birmingham, Malvern, Tamworth, and Peterborough, in addition to representatives from various parts of Shropshire. Principally through the kindness of local ladies and gentlemen, an unusually interesting collection of curiosities was displayed upon tables arranged round the room, whilst upon the walls many objects of interest were exhibited. The chief attraction, however, appeared to centre in the microscopical instruments, the marvellous specimens of life, as seen when magnified, obviously affording an interesting and instructive lesson for the majority of those present. The microscopes and specimens of organisms were kindly lent by Mr. Bolton, of Birmingham, the Rev. W. Houghton, Mr. H. E. Forrest, Mr. W. E. Harding, Mr. W. Beacall, and Mr. F. W. Richards. During the evening a couple of scientific lectures, which were made exceedingly interesting by the respective lecturers, were delivered by Dr. Callaway, of Wellington, and Mr. Luff, of Shrewsbury.

The former gentleman, in the course of his discourse upon the formation of the Wrekin, said that the view first held by the Geological Survey in respect to the formation of this mountain was that it was composed of a mass of intrusive green-stone. The first to throw doubt upon the view was Mr. Allport, of Birmingham, a man who had rendered great service to geological science, and who, by the application of the microscope, had introduced quite a revolution into that science. Mr. Allport applied the microscope to the strata rocks of the Wrekin, and ascertained that they were composed of volcanic rock lavas and volcanic ashes, which had been erupted at the surface like ordinary volcanic rocks. The next step was to ascertain the age of this volcanic series, and it was found that these lavas and ashes were several

thousand feet in thickness. He (the lecturer) commenced to study the question at Shineton, where he found a new series of fossils which proved that the Shineton Shales were Upper Cambrian, whilst underlying the Shales he found sandstone with some fossils. He next came to a band of quartzite, and at the base of the quartzite were pebbles derived from the Wrekin series, showing that the Wrekin volcanic series must have been Upper Cambrian; but he found another piece of evidence which demonstrated the matter beyond a doubt, for he discovered that the Longmynd Hills were largely derived from the volcanic rocks of the Wrekin. He found, for instance, in the Wrekin series, certain distinctive lavas, and he found similar lavas undistinguishable under the microscope from the Wrekin series, embedded in this range of hills. He ascertained also that the sandstones of the Longmynd were fragments of the same lava, so that they could conclude that the Longmynd series was derived from the Wrekin series. As to the structure of the Wrekin, it was, in the centre, composed of volcanic rocks, whilst the quartzite rested on either side. These were real strata—not a mass of molten matter forced up from below. The bedding of the rock was oblique to the axis, which was a peculiarity attached to mountains of great antiquity, and he had described this structure as plagioclinal. At the south-west end of the Wrekin there was a little rise known as Primrose Hill, which was formed of metamorphic rock—of a sort of granite—and of ordinary gneiss rocks. Then he found in the Wrekin series a conglomerate, or pudding stone as it was commonly termed, which was made by rounded fragments, and was derived from the metamorphic series of which Primrose Hill was a fragment. He had lately discovered an Archæan formation at Rushton. They were reminded that at this very ancient epoch this region was occupied by volcanoes, and these volcanoes probably extended from North Wales to Charnwood Forest.

Mr. Luff, in describing the geological character of the Clun district, dwelt principally upon the fact that he had discovered on the hill-tops in the neighbourhood large blocks of very hard stone, which were similar to those found at Rhayader. For the stones to have been conveyed by ice from Rhayader to Clun, however, the flow must have travelled in an entirely opposite direction to their invariable course—north to south—and the question therefore arose as to how stones similar to those found in the district of Rhayader got to Clun, unless they were carried by a flow running from west to east, which was very remarkable, should such have been the case. He had sent specimens of the stone to the British Association, and they had been trying to solve the problem, but up to the present their efforts had been futile. His supposition, however, was that the sheet ice and snow by which England was formerly covered gradually melted as the climate became warmer, and left these blocks of stone stranded upon the hill tops in the Clun and Rhayader districts. To add to the variety of the proceedings, Mr. Pumphrey delivered a series of interesting dissolving-view lectures in an adjoining room, whilst Mr. Lea's excellent choir contributed several glees, which were sung with exceeding sweetness and precision.

Mr. John Bennett, Mardol, Shrewsbury, exhibited fine specimens of old Salopian china, a cannon ball found near Castle Hill about 50 years ago, a framed painting of Wenlock Abbey, an engraving of Charles Darwin, and also one of the Hon. T. Kenyon, together with a painted portrait of General Lord Hill. Mr. Henry Shaw kindly sent several cases of stuffed birds of a very beautiful character; whilst Mr. W. Phillips showed a series of diagrams, illustrating the algæ which

caused the breaking of the meres; representations of British fungi, skilfully drawn from nature by himself, together with an admirable collection of lichens. Mr. George Luff had suspended on one of the walls a couple of large maps, drawn on linen, by which he illustrated his lecture, illustrating the position of Clun at the extremity of the central transverse range of the Cambrian Mountains and the mountainous nature of the district which the Clun boulders have traversed. Miss Cooper, Claremont Buildings, sent a very handsome piece of ancient Gobelins tapestry, whilst Mr. T. R. Blunt exhibited a series of views of Shrewsbury and sketches of the interior of the Abbey Church by Mr. Henry Blunt, a section of the first Atlantic cable, which possessed peculiar interest, a copy of Buddhist Inferno or Purgatory, together with an interesting model of a lunar crater and other curiosities. Two very skilfully-executed paintings of the interior of St. Julian's Church and Golden Cross Passage, by Mrs. Hay, were lent by Mrs. Auden; whilst on the mantelpiece stood two fine steel-plate engravings of Darwin, exhibited by Mr. W. Beacall, and Mr. Shaw also showed a painting of the great naturalist. A very fine painting of Butcher Row was shown by Mr. J. Laing, together with a new series of etchings of "Ye Olde Town of Shrewsbury," a painting of Stokesay Castle, of the Court in Butcher Row, and the old Welsh Bridge, together with views of other interesting spots in the town. Mr. Acherley exhibited a view of St. Alkmond's Church before the nave was taken down, whilst the Rev. D. Phillips Lewis showed several Egyptian brass trays, which were masterpieces of engraving, and specimens of Chinese fancy work, together with skilfully-inlaid Japanese panels, beautifully executed, the flowers being of coloured ivory. Mr. Morgan exhibited a magnificent collection of moths and butterflies from Berma, whilst Dr. Callaway lent a series of geological specimens showing the partial derivation of the Longmynd series from a pre-existing volcanic group, &c., being obtained principally from Shropshire. Mr. Horace Pearce, F.G.S., Stourbridge, also exhibited specimens of rocks from the granite quarries of Aberdeenshire; and the Rev. William Houghton showed specimens of fossils, rocks, and shells obtained from Egypt, together with an assortment of dried fungi. Mr. Martin J. Hardy, Shrewsbury, exhibited a splendid case of British butterflies; whilst Mr. T. S. Stooke kindly lent a glacier-scratched stone obtained from an excavation 15ft. in depth, at Llyn Slygard, Rheidol, Plynlimmon, together with cores of sandstone from a bore-hole in Leicestershire, obtained by the use of a Diamond Rock Boring Machine. Mr. Walter Southam sent a very fine specimen of the *Polyporus sulphureus;* Mr. W. Phillips also supplied a collection of *Conferva Ægagropila*, and several hedgehogs, or balls of pine needles, found in the mere at Ellesmere, and specimens of the *Polyporus nigrescens* and *Polyporus rufescens*. Mrs. Salt, Council House, exhibited a collection of Sikh armour picked up upon the field after the battle of Chillianwallah by a Shropshire man. Mr. Henry Fenton showed an assortment of fossils of echinus found in Sussex chalk, a giant ammonite found in Somerset, together with a magnificent crystal of carbonate of soda, and a remarkable specimen of potato flint. Major Southam showed a seventeenth century bottle found in White Mere, whilst Mr. J. Gray sent fine specimens of Fijian war clubs, stone hatchets, fishing hook and stone bait, together with a stone bowl found in the Dead Sea. Messrs. J. and B. Blower exhibited a series of very old views of Shrewsbury and neighbourhood, and the Rev. Canon Butler sent an extensive collection of dried plants. The proceedings throughout were of a very agreeable character.

METEOROLOGICAL NOTES.—May, 1886.

The mercurial column was high at the commencement of the month, 30·463ins. on the 5th, but fell steadily till the 13th, when the reading was 29·262ins,, after which it underwent various fluctuations till the end of the month. The range of temperature was remarkably uniform for the first ten days, the mean gradually ascending till the 7th, when a maximum of 75·3° was registered at Loughborough, and 71·8° at Coston Rectory; while at Henley-in-Arden 76·0° was recorded on the 6th. In the rays of the sun, at Loughborough, the highest reading was 132·2° on the 5th. The difference between the maximum readings on the 10th and 11th was 19 degrees. The temperature was generally low for the remainder of the month. The lowest readings occurred on the 1st, and were 26·0° at Coston Rectory; 29·0° at Henley-in-Arden; and 30·3° at Loughborough. The mean temperature was about one degree above the average, the warm weather of the 5th, 6th, and 7th contributing to what would have been otherwise a great deficiency. May is remarkable for its rainfall, for, although the first nine days were dry, the total for the month was three inches above the average. The greatest fall was at Henley on the 12th, 1·75in., at Loughborough 1·39ins., and at Coston Rectory 0·97 of an inch on the 13th. At Loughborough the total value for the 12th and 13th was 2·20ins., and for the whole month 5·16ins., while at Henley the total was 5·66ins., and at Coston Rectory 4·50ins. This is by far the heaviest rainfall in May for the past eight years; and great floods resulted, from which much damage was done to growing crops and other property.

Wm. Berridge, F. R. Met. Soc.

12, Victoria Street, Loughborough.

Review.

Hymenomycetes Britannici: British Fungi (Hymenomycetes). By Rev. John Stevenson. Vol. I. Wm. Blackwood and Sons, 1886.

The first volume of this long-looked-for work has now appeared. In regard to the known British Hymenomycetes, the "Handbook" has been for some time very defective; how much so can be seen from the simple statement that there were contained in it 452 species of the genus Agaricus, while the number in the work now published amounts to 782 species of the same genus. Besides Agaricus, the present volume contains the two succeeding genera, Coprinus and Bolbitius; and the second volume, which will comprise the remainder of the Hymenomycetes, is promised at an early date. It is not too much to say that these two volumes will be absolutely indispensable to every student of the gilled Fungi in this country. They form the necessary

complement of the "Illustrations," and the two combined will render comparatively easy in the future what has always been the hardest task of a British mycologist, the satisfactory identification of the members of the vast and polymorphous genus, to which the common mushroom belongs. The descriptions, which are founded chiefly on those in Fries's "Monographia Hymenomycetum Sueciæ," are fuller and more comprehensible than have ever been at our command before. Dimensions are given in nearly every case, with the colours of the pileus, the size of the spores, and other means of identification—a most blessed change from that curt Linnæan style in which some of the early mycologists believed. Besides this, all the sub-genera and some of the smaller sub-divisions are illustrated by wood-cuts engraved in his well-known effective style by Mr. Worthington G. Smith. W. B. G.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—Biological Section, June 8th. Prof. W. Hillhouse, M.A., in the chair. Mr. J. E. Bagnall, A.L.S., exhibited *Bromus secalinus*, *Arenaria leptoclados*, *Trifolium striatum*, *Pyrus communis* var. *Pyraster*, *Thlaspi arvense*, *Montia fontana*, *Trifolium filiforme*, from the Arrow district, the last three plants being new as records; for Mr. Wm. Mathews, M.A., the very rare *Carex Boenninghauseniana;* and presented on behalf of Mr. Fred. Enock, F.E.S., beautifully prepared slides of the Fairy Fly, *Anagrus incarnatus*, and head of Ground Bee, *Colletes Daviesana*, which were accompanied with carefully executed lithographic drawings and descriptive letterpress also by Mr. Enock. Mr. W. B. Grove, B.A. (for Mr. Hawkes), Fungi, *Œcidium tragopogonis* and *Ustilago receptaculorum* on *Tragopogon minor* from Great Barr.—Microscopical and General Meeting, June 15th. Prof. W. Hillhouse, M.A., gave an interesting account of the growth of the cocoa-nut (*Cocos nucifera*), and exhibited specimens cut in different sections to show the various parts. He referred to the nut being formed from three altered leaves or carpels, as shown by the shape of the husk and the three holes in the shell. After describing its structure and the manner of the growth of the young plant, and the ingenious way in which it escapes from the hard shell, he described the sweet albuminous fluid called "milk," and its use to the plant; and concluded his lucid and instructive lecture by a facetious reference to the juice taken from the flowers, and known as "palm toddy." Mr. J. Edmonds exhibited, under the microscope, living specimens of Polyzoa, Entomostraca, and Crustaceans sent by Mrs. Rabone, from Tenby. Mr. W. H. Wilkinson exhibited *Trientalis europæa*, and a collection of minute plants from the top of a hill in Scotland.

BIRMINGHAM MICROSCOPISTS' AND NATURALISTS' UNION.—May 17th. Mr. J. Moore exhibited specimens of the mason wasp, *Odynerius murarius*, and their nests; also cuckoo flies, *Chrysis ignita*, reared from the same. Under the microscopes: Mr. Wagstaff, two polyzoa, *Alcyonella fungosa* and *Fredericella Sultana*, and a thrips,

not yet named, found on the dracænas in the Botanical Gardens; Mr. H. Insley, a section of coal ball through a fern stem and leaf bud; Mr. Hawkes, *Œcidium violæ*.—May 24th. Mr. C. P. Neville exhibited a Silurian coral, *Thecia Swindermana*, from the Wren's Nest; Mr. F. C. Beale, slabs of Madrepore marble from Iowa and Teignmouth. Under the microscope: Mr. Wagstaff, *Euglena viridis* in the red stage, and *Draparnaldia plumosa*. A lecture was then given by Mr. Edmonds on "Photo-micrography," describing the scientific value of photographic pictures of microscopic objects, on account of the accuracy of their detail. The simplicity of the apparatus and mode of manipulation were described. The lecture was illustrated with numerous positive and negative pictures, many being shown by the lantern.—May 31st. Mr. J. Moore showed specimens of the mining bee and nest of the same, also nest of wasp; Mr. Deakin, models of snails and slugs; Messrs. Tylar and Delicate, a series of photographs of the Wren's Nest. Under the microscopes: Mr. Hutchinson, *Puccinia umbelliferarum;* Mr. Insley, transverse sections of fossil fern stems; Mr. Tylar, zoëa of *Palæmon squilla;* Mr. Hawkes, a series of slides and sketches showing the structure of *Arum maculatum;* Mr. J. Madison, clausium from *Clausilia rugosa*.—June 7th. The Photographic Section presented to the Society an album and note book for photographs and remarks on geology, natural history, and general science. Mr. A. T. Evans exhibited fossiliferous pebbles from the drift; Mr. J. Madison, a monstrosity of *Limnæa peregra;* Mr. Rodgers, larva and imago of tiger beetle, *Cicindela campestris*. Under the microscopes: Mr. J. W. Neville showed *Gamasus coleoptratorum* from humble bee; Mr. H. Hawkes, specimens of coccus found on willow twigs. A paper was then read by Mr. J. Collins on "Modifications of Floral Organs." The writer described the wonderful variety of form, colour, and perfume in common wild flowers, and various stages of development from ordinary leaves. After describing the two parts of flowers, the reproductive organs and their envelopes, the subject was considered under three heads—modifications of colour, of the perianth, and of the stamens and pistils. These modifications had generally taken place to secure cross-fertilisation, though some instances were given where self-fertilisation was most advantageous, and the flower had been modified accordingly. The writer concluded by saying that this branch of botany acted as a corrective to the selfish notion that flowers in all their variety were only to please the eye of man. The paper was illustrated by diagrams and specimens.

LEICESTER LITERARY AND PHILOSOPHICAL SOCIETY. —SECTION D, ZOOLOGY AND BOTANY. Chairman, F. T. Mott, F.R.G.S. Monthly Meeting, Wednesday, June 16th. Attendance twelve (four ladies). The Chairman reported that the Field Day Excursion to Loseby and Tilton Hill last week was attended by eight members, but that not much of special interest was met with beyond a few new localities for some of the less common plants. Mr. E. F. Cooper, F.L.S., read an extract from Grant Allen's paper on *Arum maculatum*, in which he states that cross-fertilisation is secured by insects who escape from the spathes after the "lobster-pot hairs" are shrivelled. The Chairman and Rev. A. Preston both stated that these hairs were not shrivelled in a number of old spathes which they had examined and in which flies were lying dead. The Chairman said he had examined a number of spathes in which there were no traces of flies, but the stigmas were fully fertilised notwithstanding. The pollen

seemed to fall naturally upon the stigmas below. The following objects were exhibited, viz.:—By Rev. A. Preston, heads of the fuller's teasel, and a cake of vegetable wax from Ceylon. By Mr. E. F. Cooper, dried plants from Lancashire, including *Andromeda polifolia*, *Myrrhis odorata*, &c., and a curious small green excrescence, abundant in the cracks of the bark of oaks in that district, possibly a gall of some kind. By Dr. Finch, a specimen of the cockchafer (*Melolontha vulgaris*). Rev. A. Preston gave a very interesting description of the extraordinary contrivances for insuring fertilisation in orchids, illustrated by a number of fine coloured diagrams drawn by Mr. Worthington Smith, which gave rise to some discussion as to the real origin and meaning of such apparently unnecessary complications to secure a very simple object.

PETERBOROUGH NATURAL HISTORY, SCIENTIFIC, AND ARCHÆOLOGICAL SOCIETY. — May 6th. Botanical Section.—Chairman, Mr. J. W. Bodger. Address by the Chairman on "Anthotaxis, or the various kinds of Inflorescence." Examples were given of the following, and, where possible, plants exhibited showing the same. Whorled, as in *Hippuris vulgaris*, the spike as in lavender and plantain; the amentum or catkin, as in the willow (both male and female); the locusta or spikelet in various grasses, the spadix in *Arum maculatum*, the cone in firs and branch of the larch (*Larix Europæa*), showing the ripened cones of the previous year and the delicate young fasciculated leaves of the present year; the strobilus, as in hop; the raceme, as in currant and laburnum; the corymb in hawthorn, the thyrsus in vine and lilac, capitulum in coltsfoot and daisy, the hypanthodium in fig, the umbel simple in *Allium ursinum*, compound in fennel, parsley, &c.; the cyme in laurustinus, &c.; the panicled, helicoid, and scorpioid cymes in privet, *Myosotis palustris*, and *Lymphytum officinale;* the glomerule in box, and the verticillaster in *Lamium album*. Several plants were brought by the members, and commented on in the course of the address.—May 20th. Chairman, Mr. J. W. Bodger. Address by the Chairman on the "Perianth," simple and compound, the calyx of the latter only being considered, the various terms relating to the calyx being explained and the following forms illustrated:—Partite in Anagallis, cleft or fissured in *Erythræa centaurium*, toothed in *Lychnis vespertina*, entire, inferior in various plants, superior in gooseberry, etc.; petaloid in crocus and iris, rim in madder, hooded or galeate in *Aconitum napellus*, gibbous or saccate in cheiranthus, calcarate or spurred in tropæolum and *Aquilegia vulgaris*, caducous or fugacious in poppy and Eschscholtzia, the latter being operculate, persistent in gooseberry, etc., marcescent in campanula, deciduous in ranunculus, accrescent in winter cherry (*Physalis Alkekengi*). Mr. Bodger also exhibited several wild flowers from the neighbourhood of Peterborough, and Miss Lilley specimens of *Nepeta glechoma*, *Ranunculus bulbosus*, *Cheiranthus Cheiri*, *Euphorbia peplus*, *Veronica chamædrys*, and *Viburnum lantana*.—June 3rd. Ramble to Thorpe, among plants collected were *Alliaria officinalis*, *Sagina procumbens*, *Stellaria Holostea*, *Geranium molle*, *Geum urbanum*, *Valerianella olitoria*, *Galeobdolon luteum*, *Scandix Pecten-Veneris*, and *Sedum acre*.—June 10th. Geological Section.—Geological excursion to Spital Cutting, under the guidance of Mr. E. Wheeler. Fossils found in cornbrash, *Ammonites Herveyi*, *Terebratula ornithocephala*, *Rhynchonella varians*, *Trigonia incurva* (casts), *Ostrea flabelloides*, *Pholadomya ovulum?*, *Lima rigida*, *Pecten demissus*, *Avicula echinata*.

MIDLAND UNION OF NATURAL HISTORY SOCIETIES.

ANNUAL MEETING AT SHREWSBURY, JUNE 22ND AND 23RD, 1886.

ADDRESS BY THE REV. J. D. LA TOUCHE, PRESIDENT OF THE UNION.

Ladies and Gentlemen,—I propose in the address which I have the honour to deliver on this occasion, first, to recapitulate briefly the subjects which have occupied the attention of the Naturalist Societies of this Union during the past year; secondly, to enumerate the various points of interest which this county and neighbourhood afford; and lastly, to allude to the labours of Charles Darwin, that illustrious man, of whose connection with the town of Shrewsbury by birth and family its inhabitants may feel justly proud.

I.—In reference to the first subject, the difficulty lies in selection. A glance through the pages of the modest but useful monthly periodical which is devoted to the record of the operations of these societies reveals a quite embarrassing number of papers on a multiplicity of subjects connected with science in its varied branches, as well as abundant evidence, from the vast number of specimens and objects of natural history exhibited from time to time at the meetings of the microscopical and literary societies, especially in Birmingham, Leicester, Peterborough, and the occasional notes of field club meetings, that there is no decline in the interest with which natural science is pursued.

Among the most important of the papers which have appeared in the "Midland Naturalist," I notice a series by Mr. Harrison, on the "Pre-carboniferous Floor of the Midlands." That the geological interest of this area is far from being exhausted or fully explored has been proved by the recent and unexpected discovery of rocks of pre-Cambrian age near Atherstone, at Hart's Hill. These had previously been mapped by the Survey as carboniferous; again, the altered rocks near Rowington, in Warwickshire, supposed to be millstone grits, are now decided to be Cambrian; and near Nuneaton sundry purple and other shales, classed as carboniferous, are shown by Professor Lapworth to be Cambrian, and yield Cambrian fossils, such as *Olenus*, *Lingula*, &c. Mr. Thompson has also contributed some valuable papers on "The Lias of Northamptonshire," with some carefully prepared lists of fossils found there. Those interested in physiology will appreciate the papers on "The Ear and Hearing," by Mr.

Abel, in which the subject is treated both popularly and in such a way as to convey much instruction to the general reader. Mr. Bagnall, in his paper on "Flowering Plants and Ferns in the County of Warwick," has been doing a service of much importance to the botanist, and one which well deserves to be imitated in other counties. Of the addresses, too, by the presidents of field clubs, which are occasionally published in this periodical, I may especially mention that by Mr. Waller, which is full of interest, especially in relation to an earthquake of exceptional severity which prevailed over the east and south of England, and which presented some remarkable features. Mr. Waller also draws attention in this address to the change continually going on in the composition of minerals, a subject which must largely engage the attention of the geologists of the future, and modify very considerably the opinions that have hitherto been held as to the origin and nature of rocks which are called metamorphic. I may, perhaps, be pardoned in alluding to a paper of my own in the "Geological Magazine" in the year 1863, upon this subject, in which I suggested the probability that the great strata of limestone, so characteristic of our Silurian rocks, and even beds of coal, owe their origin, in a large degree, to a gradual process of segregation, carried on through countless ages. We are all familiar with the fact that the fossil remains of the strata above and below these deposits are deficient, if not quite destitute, of the substance which preponderates enormously in them. You seldom find a fossil shell with more than a mere vestige of the carbonate of lime of which it was composed; and in the coal measures you see huge trunks of trees and stems of plants which, except the thinnest film on their surface, have parted with all trace of the carbon which at one time made up their entire substance. Its place has been wholly taken by the sandstone or shale in which these remains are found. A process has been quietly going on whereby, without disturbing the most delicate markings on their surface, the fossils have parted with the original matter of which they were constituted; and this, I would suggest, is found accumulated in the strata—in the former case of limestone, in the latter of coal—which is in close proximity to the beds which contain them. Take the entire thickness of the strata throughout which the fossils and other organic remains are distributed; calculate the mass of carbon or of carbonate of lime that must once have entered into their composition, and its equivalent will largely be found in the adjacent strata, which are now entirely composed of those

substances. Permanent as we suppose the everlasting hills, changes are incessantly at work in them, breaking up old combinations and forming new ones. As the earth spirit says to Faust :—

> In the currents of life, in action's storm
> I float and I wave
> With billowy motion.
> Birth and the grave
> A limitless ocean.
> A constant weaving
> With changes still rife,
> A restless heaving,
> A glowing life—
> Thus time's whirring loom unceasing I ply,
> And weave the life garment of Deity.

I must say a word on the means by which the societies and field clubs in this Union have endeavoured to turn their time and resources to good account. I see that besides their periodical meetings for the interchange of opinion, the exhibition of specimens and the reading of papers, some, notably the Birmingham and the Peterborough Natural History Societies, have adopted the plan of the members preparing some definite book for discussion. Where members live within a reasonable distance of each other, this is obviously an excellent means of acquiring definite information, and qualifying them for the work of original research. The members of the Caradoc Field Club have for some years past offered prizes to the scholars of elementary schools for collections in botany and geology. I must admit that, although some good collections have thus been made, the scheme has not been widely adopted, owing no doubt to the fact that it involves the constant attention of some one to direct the efforts of the lads, and this requires more time than can usually be spared; otherwise, where the services of such persons are available, they might profitably be expended in promoting habits of observation among the young and the extension of scientific knowledge. The splendid volumes published by the Woolhope Club on the varieties of the apple and pear, now completed, furnish an example of what valuable work our clubs can perform when they apply themselves to some definite object of local interest. It is in this, perhaps, more than in any other way that they have it in their power to promote the objects they have in view.

II.—There are not probably in England many counties which furnish more varied objects of interest to lovers of Nature and of History than Shropshire. Its hills and valleys have furnished the chief materials from which the geologist has been enabled to decipher the successive changes which

have throughout the dim and distant ages of the past taken place in the earth's crust; building up from primordial matter the floor, which, itself upheaved, contorted, re-formed, became in after-time the stage on which was to appear the marvellous beauty of Nature as we now behold it, the wealth of vegetation and of animal life, and at last the home of man. I believe that I do not claim more than is just in saying that to the description of the Palæozoic and Archaic rocks of Shropshire by Murchison, Sedgwick, and others, is chiefly due the key which has unlocked these ancient treasures, and solved what had previously been looked upon as a profound mystery. Those who had the privilege of taking a part in the discoveries of some forty or fifty years ago will testify to the enthusiasm which prevailed among the geologists of the time. It was like the exploration of some newly-found continent, where each object is viewed with astonishment and suggests some fresh ideas. Pioneers there had been, men like T. Lewis, of Aymestry, and Dr. Lloyd, of Ludlow, who, by their patient research and careful collection of specimens, as well as by their own intelligent correlation of facts, had paved the way for others, such as Murchison, who, with wider information, and the faculty of describing and writing, were enabled to assimilate and reduce to system the results of their labours. The extraordinary wealth of almost all these strata in fossil remains furnished the clue to their history and arrangement. Founded partly on the evidence which these supply, and partly on the relative position of the strata, which are here very persistent and well marked, the Silurian system was constructed. But like most geologists of his age, Sir R. Murchison was apparently unable to abandon the notion that the fossiliferous strata here explored marked the limits of organic life. He had reached, as he thought, the *Ultima Thule* of organised creation, All beyond was without form and void. Nor could he ever free his mind from the belief in a number of successive and spasmodic acts of creative power, nor entertain the view that, however remote these remains may be, they imply progenitors from whom they have descended. Yet subsequent research has shown that upon these points that eminent observer was in error. The labours of Dr. Hicks have proved that though our Shropshire Cambrians contain only a few obscure impressions of the worms that crawled over their surface when they were soft mud, the very same strata at St. David's Head are stocked with a varied and abundant fauna. And as for the correlation and classification of still older rocks, the researches of Dr. Callaway and his intelligent observation of tracts that previously had either escaped notice altogether or been carelessly included with more

recent ones, have within the last few years clearly demonstrated the fact that underlying the Cambrians, unconformable with them, in some places in contact with them, in others with more recent rocks, is what he calls an Archaic formation, consisting of sedimentary and partly of volcanic deposits.

It would manifestly be beyond the limits of this address to enter minutely into a description of this part of the subject. Those who purpose joining the geological excursion to-morrow will have an opportunity of seeing with their own eyes the structure, the framework as it were, of the county. They will observe the ridge of hills called the Longmynd, running N.E. and S.W., which are composed of Cambrian rocks. These have, towards the west, thrown off the Llandeilo or lower Silurian, which rest on them conformably, and, by a huge fault on the east, are brought into contact with the more recent Caradoc or Bala formation, from which a regular succession of the Silurian up to the old red sandstone and on to the carboniferous and coal measures in the Clee Hills can be traced. The evidences of the Archæan, or Pre-Cambrian, to which I have alluded, are more obscure and will not come under your notice, but for those who elect to go on the Wroxeter expedition I would call their attention to a very remarkable exposure of what Dr. Callaway has now proved to be an equivalent of the Tremadoc series, a formation which, underlying the Llandeilo, had been supposed to be entirely absent on the east of the Longmynds. This is well exposed in Shineton Brook, and is replete with fossils, the chief of which is a large trilobite, the *Ogygia Homfrayi*, which is found in a very perfect condition.

In a tract which has been so thoroughly explored for several years past as this has, it is not to be expected that many new forms can now be discovered ; nearly every quarry and section has been carefully searched, and we must wait for fresh exposures to add to the list of fossil remains that we now possess. But that this list is far from exhausted is proved by the extraordinary number of entirely new forms, especially of *starfish*, *Pterygoti* and *Ceratiocaris*, which were brought to light a few years ago in a very small area, at a place called Church Hill, near Leintwardine. The fact that the accidental opening of a quarry at any point over so large an area may at any moment reveal so great a number of entirely new genera and species may well impress our minds with the imperfection of the record of the continuity of organic life, which has been so forcibly pointed out and insisted on by Sir C. Lyell and Mr. Darwin. It is often asserted triumphantly, as a crushing answer to the evolution hypothesis, that the absence of the links which unite, *e.g.*, an *orthoceras* of the Palæozoic era with an *ammonite*

of the Secondary, is an insuperable objection to the supposition that the latter is the natural outcome of the former. But it has always seemed to me that such objections are extremely feeble. Every new addition to our knowledge may fairly be expected to supply us with missing links; to ask for them at present is unreasonable, considering the very small portion of the surface which has as yet been explored. As an instance of how an organism, though actually existing, may easily escape our most careful research, I would briefly mention certain minute bodies found some years ago in the Downton sandstone, and which were long supposed to be the capsules of a *Lycopodium*. Careful examination, however, of microscopic sections of these bodies shows that they are composed of an alga, closely resembling the modern *Rivularia*, and that this has been invaded, as sometimes still happens, by another, almost, if not quite, identical with the *Œdogonium*, which exists this day in our lakes and rivers. But for the chance blow of a geologist's hammer in an exposure, not three yards square, in one of the shrubberies of Downton Castle, we should never have known of the existence of this link between the present and a remote past. No one can reasonably doubt that, although as yet undetected, this fragile plant never ceased to exist somewhere, through all the mighty changes of which this earth has been the scene, and that it thus furnishes a strong argument in favour of the continuity of life. Another instance of the removal to an earlier date than had previously been known of the existence of an organism is supplied by the discovery of *Lithodomus* borings in the Aymestry limestone by my friend, Professor Corfield. From his acquaintance with the Oolitic formation, in which specimens of these abound, he was struck by the resemblance to them of certain pits or depressions in the surface of the corals which abound at Weo Edge. Sections of the specimens collected by him are now in a case at the Kensington Museum, and figures of these appear in the "Geology of Shropshire" lately published, clearly showing the bivalve lying in the pit which it has burrowed into the coral. And, lastly, the manifold remains found in that most remarkable deposit, called the Ludlow bone-bed, an exposure of which at Norton I hope some of us may visit tomorrow, bear striking testimony to the remark that vast multitudes of animals must have abounded during long periods of time, which have left little or no trace of their existence. Germane to this subject is the discovery within the last year of insects and scorpions in rocks of Silurian age in Scotland, France, Sweden, and America. The first of these consists of a wing of a *Blatta*, or cockroach, from the

middle Silurian of Largues, in France, and which has been described by Brongniart; and the second, of specimens of fossil scorpions in the Ludlow beds of Scotland, Gothland, and America. The latter differs from the former in many respects, and attains a length of about 12½ inches. Again, in a coal-pit in Bohemia, a scorpion of the little known order of *Pedopalpi* has been found, which presents a great similarity to present forms, and the same pit has yielded four new spiders, raising the number of Palæozoic *Arachnida* to thirty-four. To an interesting paper by my friend, the Rev. P. B. Brodie, published in the "Naturalist's World," I am indebted for this information. Of more recent geological events, viz., those connected with the ice age, some important discoveries have been made in our county by Mr. Luff in the neighbourhood of Clun. His attention has been for many years attracted to the vast number of travelled blocks scattered about on the picturesque hills which surround that village, and he has with very great industry and care mapped down their position, and tracked them over hill and dale to the source from whence they came. He finds that they vary in size from small fragments to blocks of ten feet long;—that they can be traced over a tract some twenty-three miles in extent to the flanks of Plynlimmon, and to Carrig Gwinnion, by the side of the Wye, two miles from Rhayader—the latter boulders consisting of a grit very marked in character;—that by far the largest blocks are found at the greatest distance from their source;—and that many of them lie at higher elevations than Carrig Gwynnion, pointing to the conclusion that they have been floated from that locality on icebergs.

In concluding this part of my subject, I would refer to some statistics, kindly furnished me by Mr. Watts, as to the number of works bearing more or less on the geology of Shropshire, of which he is compiling a list. They amount, it seems, to no less than about 300, probably more than less. The record begins in 1712 and goes to 1885. The authors' names include Aitkin, Murchison, Conybeare, Prestwich, Lyell, Williamson, Ramsay, Davidson, Salter, Jones, Milne-Edwards, Owen, Lightbody, Roberts, Randall, Morris, Maw, Woodward, Ricketts, Brodie, La Touche, Hall, Mackintosh, Eyton, Davies, Hicks, Hopkinson, Lapworth, Crosskey, Allport, Callaway, Symonds, Salwey, Bonney, Houghton, Nicholson, Etheridge, Duncan, Vine, Flyght, Harrison, and Reade. Such are among the more important contributors. The most active years, in each of which there are over a dozen references, are—1865 (17), 1869 (12), 1870 (14), 1871 (15), 1873 (20), 1877 (12), 1879 (15), 1882 (14).

(To be continued.)

NOTES OF AN AMERICAN TOUR.

BY W. P. MARSHALL, M.I.C.E.

(*Continued from page 182.*)

The great Yosemité Valley was next visited, going north by train to Madeira Station on the way to San Francisco, and then by ninety miles of coach drive, that took a day and a half, stopping for a night at an hotel that is established on the way, in the midst of the woods. This was a remarkable drive, starting 2,000 feet above the sea, and passing over a ridge 5,500 feet high into the Yosemité Valley, which is 4,000 feet above the sea, with many intervening ascents and descents. The road is mostly either up or down very steep hills, many of great length, crossing many streams with sudden sharp bends, and the road nearly axle deep in dust or in mud, according to the weather. The journey was by a six-horse coach with capital driver and first-rate horses, and was very enjoyable, with the numerous fine views overlooking great wooded valleys that ran down towards the coast; but the ride would have been very different in wet weather. The driver cannot reach the leaders of his team with the whip on account of the road lying so much through forests, and indeed the whip is but little used, and the horses are mainly driven by the voice and a private store of small pebbles kept at the back of the driver's seat to touch up the leaders occasionally.

A fascinating sight of the great Yosemité Valley is obtained, bursting suddenly into view on emerging from the forest at a turn of the road 1,000 feet in height above the valley, that commands a view of two-thirds of the length of the valley. This wonderful valley exceeds all expectation in the reality, formed on each side by extraordinary granite cliffs that are more than half a mile vertical height from the valley, and extending for a length of eight miles. From the floor of the valley you climb up a height as great as Ben Nevis, our highest mountain, to reach the top of the valley sides, and the floor of the valley itself is as high as the top of Ben Nevis above the sea. Most lovely views of the valley are obtained during the ascent, and the clearness and transparency of the air is quite misleading, making the distances appear so much less than they really are.

This Yosemité Valley is situated on the western slope of of the Sierra Nevada range of mountains, and is one of the transverse clefts of these mountains, running from east to west towards the Pacific. The valley is eight miles long, and

from one to two miles wide; it has an irregular serpentine outline, and is of a very striking and unique character. The sides are formed by lofty granite cliffs that have nearly vertical faces for the greater part of their height, and only a small proportion of slope formed by débris at the base of the cliffs. These gigantic cliffs are as much as half a mile to three-quarters of a mile in height above the valley, and in one part rise to nearly a mile vertical height (4,870 feet height); but the clearness of the atmosphere is such that this great height is not at all realised until the actual ascent of the cliffs is made, when some hours' climbing is found to be required in getting to the top.

A special feature of the valley is the waterfalls, of which there are several, taking prodigious leaps over the great granite cliffs. The largest of these, the Yosemité Fall, takes a single leap of 1,500 feet (the highest waterfall known), followed by a second leap of 500 feet, and a third of 400 feet, forming with some intermediate shorter leaps a continuous waterfall of 2,600 feet height, as seen from the valley below. One of the waterfalls, called the Bridal Veil Fall, is of singular beauty; the total height of fall is 900 feet, of which the first 600 feet is a clear leap, but the quantity of water, thirty feet width at the top, is not sufficient to make continuous solid water to the bottom, and the result is that the water is mainly dispersed in the air as spray, which is floated about by the wind like a gauze veil.

The River Merced flows through the valley, and this is well wooded throughout, and very fertile in plants, forming a beautiful wild garden of flowers; and the shrubs and flowers extend far up the sides of the valley. There are three hotels in the middle of the valley, where the coach-road from the railway terminates, and many very interesting and charming excursions can be made from there on foot or by ponies, getting up to the top of the cliffs in several directions. The end of Spring and the begining ot Summer is the most favourable time for seeing the valley, when the waterfalls are well filled by the melting of the snow that covers up the whole district in Winter, on account of its great elevation above sea level, although in the same latitude as the South of Italy.

The geological features of the Yosemité Valley are very unique, and specially interesting as to the difficulties in attempting to explain its formation. The sides are precipitous granite cliffs of great height, that do not exhibit any signs of erosion by water action. The faces of these cliffs are, indeed, being continually renewed by the weathering action (mainly of frost in winter), which is continually scaling off

slabs from the face of the cliffs. The granite presents the appearance of having been laminated vertically from some cause, and undergoing a process of being split off in successive slabs of one inch to a foot or more in thickness. In the course of the ascent by the zig-zag paths up the cliffs there are seen large quantities of these slabs, partially detached from the face of the cliffs, some of very large extent, and looking ready to fall with the frost of another winter. Now, this weathering action is, at the present time, widening the valley surely though slowly; and if carried back long enough a similar action would have sufficed for the excavation of the entire valley from some small commencing fissure; but a difficulty that presents itself to this view is the entire absence of any large accumulation of débris as a result of the excavation of the entire valley, which is from one to two miles in width, and more than half a mile in vertical depth. Also, the river running through the valley is, at the present time, a quiet stream, not capable of carrying away any considerable quantity of débris.

In reference to this it has to be noticed that the material of the cliffs, granite, is already far gone in decomposition by the time it has become sufficiently jointed and loosened to allow of its being detached by the weathering action, and will not require much further decomposition before it becomes completely broken up into the condition of the soil of the valley.

A point of special interest and difficulty in connection with this question is the peculiar condition of the Half Dome, which is at the upper part of the valley, and is the highest point of the surrounding rocks, being nearly one mile vertical height from the floor of the valley. There are several domes around the valley, consisting of hemispherical elevations in the granite of large size, and this Half Dome is the largest of them, being a quarter of a mile in height above the surrounding country and nearly half a mile in diameter; and the special feature of it is that the dome is cleft vertically, and more than one-third of it removed, leaving a vertical face towards the valley, but without any visible trace being left of the missing portion. It has been suggested that the whole valley is the result of volcanic agency, and that this dome was split by some upheaval, and the lost portion swallowed up in a chasm opened by the upheaval. The idea, however, of the weathering action by vertical jointing may also be applied to the formation of the Half Dome, provided that its structure admits of *vertical* jointing; but there is a curious circumstance in one of the other domes that is accessible for examination, the Sentinel Dome, which

is *spherically* jointed, and is weathering away in concentric spherical laminations of one to several inches thickness. This dome is situated in the middle of the valley, and is the next highest point to the great Half Dome, being only 700 feet lower. There are reported to be nearly 100 of these domes scattered about the surrounding district.

At thirty miles distance from the Yosemité Valley, on the way back to the railway, is the celebrated Mariposa Grove of Big Trees, the great "Sequoia Gigantea." This grove is situated on the southern slope of a ridge of the Sierra Nevada mountains, at a height of 6,600 feet above the sea, in a sheltered situation a little below the summit of the ridge.

The "Big Trees" grow in a forest of large extent, but they are confined to a small portion of the forest of only a mile or two in extent, and they are limited in total number of trees to only a few hundreds. Some of the finest of the big trees have suffered from former injury by fire from the Indians, but the whole Mariposa Grove (as well as the Yosemité Valley) is now in the care of the State, and set apart for ever for "public use, resort, and recreation."

The largest of the trees reaches the extraordinary height of about 400 feet, and the stem shoots up to as much as 200 feet high from the ground before the first branch occurs, which is itself about six feet in diameter. The stem is more than 100 feet circumference or thirty-three feet diameter at a yard above the ground, and one of the fallen trees has been found to be as much as six feet diameter at a height of 300 feet from its base, and fifteen feet diameter at half that height.

One of the living big trees has an archway cut through the stem at the base, large enough for the coach to drive through, that brings the visitors to the place. The big trees are surrounded by gigantic pines of extraordinary size, reaching to 200 and 250 feet height, which would themselves be objects of great attraction if they were not dwarfed by their giant companions. The bark of the big trees is as much as eighteen inches thickness, and from the number of concentric annual rings seen in the stem the age indicated is as great as 3,000 years. There are three other Groves of Big Trees—Calaveras, Fresno, and Tuolumne—all situated similarly to the Mariposa Grove, and in the same mountain district; and in the Tuolumne Grove are the remains of a fallen tree still larger than those at Mariposa, showing a diameter of as much as forty feet, and a portion of the hollow trunk which is lying on the ground has a road through it large enough for three horses to pass abreast.

(To be continued.)

THE MONUMENTAL BRASSES OF WARWICKSHIRE.

BY E. W. BADGER, M.A.

(*Continued from page 187.*)

MIDDLETON. I.—*Rich. Byngham, justice of the King's Bench*, 1476, and *widow Margaret. Haines.*

These effigies, which are 3ft. 2in. and 3ft. long respectively, are in good preservation, but have been relaid (at the entrance of the chancel), as there are no matrices for the four shields of arms shown in Dugdale's illustration of the brass. The justice wears a coif or skull-cap, a fur-lined gown, open in front, with high collar and wide sleeves, and a large cloak fastened upon the right shoulder with two buttons. Upon his feet (which rest upon turf, with trefoil and other plants springing from it) are pointed shoes. The lady wears a wimple or *barbe*, the sign of widowhood; a large kerchief, and a long loose cloak, beneath which is a kirtle girded at the waist. Upon her right wrist hangs a rosary of forty beads, four larger beads marking the decades. Attached to the rosary is a tassel.

Upon a plate 2ft. 9in. by 3in. is this inscription :—

Hic jacent dn̄s Ricardus Byngham miles et Justiciari' de banko dn̄i regis qui obiit xxii° | die maii ao dn̄i millo cccc°lxxvi° Et dn̄a margareta sui cōsors quor' aīābs ppicietur deus amē.

In English :—

Here lie Sir Richard Byngham, knight, and justice of our lord the King's Bench, who died the 22nd day of May, A.D. 1476, and Lady Margaret his wife; to whose souls God be merciful. Amen.

There is an illustration of this brass in the Trans. of Arch. Sect. of Birmingham and Mid. Inst., 1874, p. 17.

II.—*Dorothy, w. of Ant. Fitzherbert*, 1507. *Haines.*

Upon the north wall of the chancel, in an arched recess, is a small brass shield with these arms: Arg., a chief vaire, or. and gu., over all a bend sa., for FITZHERBERT impaling WILLOUGHBY or., two bars gu., charged with three water bougets, arg.

Underneath, on a small plate, is this inscription :—

Hic jacet Dorothea filia Herici Wiloughby | militis ac uxor Antonii ffitzherbert qe obiit | quto die nouebris ao dni mocccccc septio.

Translation :—

Here lieth Dorothy, the daughter of Henry Wiloughby, knt., and wife of Antony Fitzherbert; she died on the 4th day of November, A.D. 1507.

The letters are carved in relief and are beautifully formed; the ground of the plate is coarsely scored, probably to prepare it for the enamel which we may suppose once surrounded the letters. The original gravestone has lately been uncovered during some alterations to the chancel, and this brass, which had been fastened to the wall upside down, has now been relaid in its original position.

Margaret Byngham, commemorated by No. I., was a sister of Sir Baldwin Frevill, and widow of Sir Hugh Wiloughby, of Wollaton, in Nottinghamshire, and great-grand-mother of Dorothy Fitzherbert. Antony Fitzherbert was a justice of King's Bench. Dugdale gives an illustration of this brass.

At NAPTON-ON-THE-HILL there is, behind the organ, an incised slab and a stone with matrices, and a brass shield inlaid in it.

PACKINGTON (GREAT).—*John Wright, Vicar,* 1527. *Haines.*

Nothing remains of this memorial save the inscription, upon a plate 1ft. by 4in. There are matrices for the four evangelical symbols, and a small figure of a priest in eucharistic vestments (see the account of a priest at Coleshill). The words of the inscription are—

Hic jacet dns Johes Wryght | qunda vicarius istius ecclie q obiit | viiio diee mes' marcii anno dni | mmo ccccco xxviiio cus aie ppciat' de'.

In English :—

Here lieth Sir John Wright, sometime vicar of this church, who died the 8th day of March, A.D. 1527; to whose soul God be merciful.

PRESTON BAGOT.—*Elizabeth, w. of Wm. Randoll, "legis consiliarius,"* 1635. *Haines.*

This effigy, which is now upon the S.W. wall of the chancel, has lost its head. It represents a lady in a bodice, with lappets at the waist, and frilled cuffs. The skirt of her dress is quite plain.

The following inscription is upon a plate 1ft. 7in. by 9in. :

DORMITORIVM ELIZABETHÆ RANDOLL RICHI KNIGHTLEY
DE BVRGHE HALL IN COM : STAFF : ARMIG FILIÆ SECVNDÆ
CONIVGIS WILLI : RANDOLL LEGIS CONSILIARII, QVÆ PER
BREVES ALIQVOT IN HAC PAROCHIA MENSES DEVOTISSIMA
DEO, AMICISSIMA POPVLO, PRÆCHARISSIMA MARITO SVO
FÆLICITER VIXIT, ET DEIN CVM OPTIMA APVD PIOS MEMO
RIA, NON SINE PLVRIMA LAMENTATIONE, SPIRITVS EIVS
REDIIT DEO ILLIVS DATORI 12° DIE DECEMBRIS A° DNI : 1635
CVIVS TAMEN CARO VIVA SVB SPE HIC SECVRE REQVIESCIT
AC PLENA INTEGRÆ P IESVM SVUM REDEMPTIONIS AD
VENTV SVO PROXIMO AD OPTIMAM RESVRRECTIONEM.

Translation :—

The resting-place of Elizabeth Randoll, second daughter of Richard Knightley, of Burgh Hall, in the county of Stafford, Esq., wife of William Randoll, barrister-at-law. For a few brief months she dwelt happily in this parish, most devoted to her God, most friendly to the inhabitants, most especially dear to her husband, and then with blessed memory among the good, and amid very much sorrow, her soul returned to God who gave it, December 12th, 1635. Her flesh, however, living through hope, rests here tranquilly and in full assurance of perfect redemption to a blessed resurrection through her Saviour at His next coming.

RYTON-ON-DUNSMORE. I.—*Rich. Wylmer, farmer*, 1527, *and w. Joan. Haines.*

Unfortunately nothing remains of this brass except a group of six girls, and a plate, 23in. by 3in., bearing this inscription :—

All crysten peplle walkyng alone : he holde the ymages of y^is^ stone : wher lyen | Rychard Wylm^r^ & hys wyffe Johne : the xxiiij day of mey w^t^ good recorde he | depted owt of y^s^ world y^e^ yere of o^r^ lord a | mv xxvii to whose sollys Jesus geve coford | farm^r^ of y^is^ towne well knowne was he : of yo^r^ charite say pr nr and ave.

For the rubbing of this brass I am indebted to a lineal descendant of Rich. Wylmer, Mr. Joseph J. Green, of Stansted Montfichet, Essex, who informs me that he *purchased* the brass of the vicar and churchwardens at a time when it was in danger of being entirely lost. Glad as we may be that the brass is being carefully preserved, we feel bound to protest against the conduct of the vicar and churchwardens of Ryton, and regret the want of an adjective strong enough to characterise them.

II.—*Moses Macham, minister*, 1712, *æt.* 63. *Haines.*

Upon the north wall of the chancel is a plate 15in. by 5in., inscribed as follows :—

Here lyeth the Body of Moses Macham Minister of Ryton | who died June y^e^ 29^th^ 1712. Aged 63 years.

Lo here doth ly a shineing light. wrapped up in the shades of night | the Sheppard is took from his sheep. but o would they his doctrine keep | and practice y^e^ Rules that he did give. so shall y^e^ Pastor and y^e^ People live.

At the bottom right-hand corner is engraved a skeleton underneath a tree ; and near this is a dark lantern standing upon a coffin, the former being the precise length of the latter.

The wife of Moses Macham lies buried in the south-east part of St. Philip's Churchyard, Birmingham.

SOLIHULL. I.—*William Hyll, gent.*, 1549, *ws. Isabell and Agnes, and* 18 *children. Haines.*

The seven plates forming this memorial are now fastened upon an oak tablet which is hung upon the north wall of the tower. The effigies are about 2ft. long. One represents a man with long hair, who is clad in a loose gown edged with fur and having wide sleeves. This garment, which is thrown open at the chest, shows an under-tunic buttoned at the neck. The cuffs of this dress are also visible. Fastened to the left side of the girdle is a gypcière. The ladies wear the kennel-shaped head-dress, small shawls upon their shoulders, and dresses with puffed and banded sleeves. The dresses are gracefully draped at the sides and reveal plain under-skirts. The shoes of all three effigies are broad-toed. The figures are singularly like those at Aston, with which they should be compared. A plate 2ft. by 3½in. bears this inscription :—

Of yo charite pray for the sollys of William Hyll gētilman and for | Isabell and Agnes hys wyffys wich William decessyd the vi day of | december yn the yere of ow lorde god a m^o^ ccccc xlix on whose | sole Jhū have marcy amen.

Beneath this are figures of 18 children, not arranged under their respective mothers as is usually the case, but in three groups, viz., four sons, eleven daughters, a son and two daughters. There is an illustration of the brass in Part I. of the "Warwickshire Antiquarian Magazine."

II.—*William Hawes, w. Ursula, and* 8 *chil.*, 1610.

This brass, not mentioned by Haines, is in a tablet with moulded border, at the east end of the north aisle. It is about 2ft. by 19in. William Hawes has close-cropped hair, moustache and beard, ruff, and gown with false sleeves (compare the brasses at Chadshunt and Barton). He kneels upon a cushion at a prayer-desk, upon which is an open book. Opposite to him is his wife in a Paris hood, ruff, and dress with plaited stomacher. Upon the tiled pavement behind the father kneel four sons in cloaks, doublets, and knee-breeches; on the opposite side are four daughters dressed like the mother, but without hoods.

Above the husband's head is a shield with these arms: sa., a chevron arg., betw. three leopards' heads or. for HAWES, and this inscription: 1610 WILLIĀ HAWES ÆTATIS 80. Over the wife's head is this shield: gu., a chevron arg., pellettée, charged with two bars gemel of the field, betw. three lions' heads erased or. for COLLES, and the inscr. 1610 VRSVLA COLLES ÆTATIS 70. Between the shields, within a double-rayed nimbus, are the words "Jehouah GOD." At the bottom of the plate are these lines—

HERE WILLM̄ HAWES AND VRSVLA HIS WIFE
THER BODIES LIE THER SOVLES WTH CHRIST IN LIFE
WHOSE HOLY SPIRIT DID SO DIRECT THER WAYES
THAT IN HIS FEARE THEY LIVED TO AGED DAYES
IN ENDLES JOYE THEY NOW WTH CHRIST REMAINE
BY WHOSE BLOOD ALL SALVATION DOE OBTAINE.

Below this monument hangs a tablet of wood, upon which, between two trees, the one bearing hips and the other *haws*, are two epitaphs, one of fifteen verses in Latin, the initial letters spelling "GVLIELMVS HAVVES," the other of thirty verses in English. Both will be found in the "Warwickshire Antiquarian Magazine," Part I., p. 26.

On the wall of the north transept are the following inscriptions upon brass plates:—

III.—HERE LYETH THE BODY OF ANNE AVERELL | WIFE OF GEORGE AVERELL GENT: AGED | 92 YEARES, BVRIED THE 9TH DAY OF | DECEMBER 1633.

IV.—HEERE LYETH THE BODY OF GEORGE | AVERELL GENT AGED 98 YEARES BV | RYED THE XXII DAY OF JVNE 1637 HEE | HAD ISSVE BY ANNE HIS WIFE FOVRE | SONNES AND THREE DAVGHTERS.

V.—HERE LYETH Y^E BODY OF HENRY AVERELL | GENT SONNE OF GEORGE AVERELL GENT | WHO LIVED A BATCHELOVR AND DEPARTED | THIS LIFE Y^E SEVENTH DAY OF NOVEMB | IN THE YEARE OF OVR LORD 1650. | AND IN THE 73^D YEARE OF HIS AGE.

VI.—This ſtone is not placed here to | perpetuate the memory of the Perſon | interred beneath it, but to preserve | her Aſhes, ſacred from violation.

Therefore
Good Friend, for JESVS ſake forbear
To dig the Dust enclosed here. 1746.

Compare Shakespeare's epitaph at Stratford.

SUTTON COLDFIELD. I.—*Barbara Eliot*, 1606, *and* 2 *chil. Haines.*

On the north wall of the chancel is an effigy 19in. high of a lady in a large calash or hood, ruff, and dress with tight sleeves, plain cuffs, stomacher composed of overlapping scales, and plain skirt projecting at the hips, where it is probably extended by a *farthingale* of whalebone. The lady also wears low-heeled shoes tied with a ribbon. Standing upon a tiled floor alongside their mother are a boy, dressed in a gown partially open down the front, like that worn by the boys of Christ's Hospital, and a girl dressed like her mother, but with a Paris hood instead of the immense calash.

This inscription is upon a plate 21in. by 5in.:—

HIC JACET BARBARA ELIOT FILIA RAPHAELIS SIMONDS GE
NEROSI VXOR MAGISTRI ROGERI ELIOT RECTORIS HVIVS
ECCLESIÆ QVÆ OBIIT MENSE SEPT. AN° DNĪ MILLESI. SEX
CENT: SEXTO AN° ÆTATIS SVÆ VICESIM. QVARTO ET HABVIT
EXITV. RAPHAELEM ELIOT ET ELIZABETHĀ ELIOT

In English:

Here lieth Barbara Eliot daughter of Raphael Simonds gent., wife of Master Roger Eliot rector of this church; who died in the month of Sept. A.D. 1606, in the 24th year of her age, and had issue Raphael Eliot and Elizabeth Eliot.

Roger Eliot, mentioned in the inscription, was presented with the living of Sutton in 1595 by a widow lady named Elizabeth Eliot. (See Dugdale, p. 642.)

II.—*Josias Bull, gent.*, 1621, *with* 5 *children. Haines.*

Upon the wall facing the last is the effigy of a man, 16in. long, in ruff, civilian's gown reaching to the ankles, doublet,

knee breeches and hose; a similar figure to that at Barton. Above his head is a shield, 7in. long, with the arms of Bull impaling Botlier. Upon a plate, 19in. by 6in., is this inscription:—

Here vnder resteth ye body of Iosias Bvll late of this towne gent: he tooke to wife Katherine Walshe widdowe davghter of Willm̄ Botlier of Tyes in Essex Esq.
By whom he had issve 4 sonnes and 1 davghter: Josias Henry, George, John, and Ann: He deceased the 29th of March Anō 1621. Abovt ye age of 50 yeares

The children are represented upon a small plate beneath the inscription.

(To be continued.)

THE PRINCIPLES OF BIOLOGY.
BY HERBERT SPENCER.

Exposition of Part IV., Chaps. I and II.
BY W. B. GROVE, B.A.*

The first chapter of this part introduces the problems of Morphology, *i.e.*, the discussion of the modes in which the shapes of organisms and of their proximate elements have been produced. It is shown that these problems fall under two heads:—(1) We have to consider the degree of composition of the individual; (2) to investigate the outlines or forms of it and its component parts, and to show in both cases that our results agree with the general theory of Development. The two sets of factors by which Mr. Spencer says this morphological development is caused are the well-known mainstays of Darwinism—Inheritance and Adaptation.

"Evolution implies insensible modifications and gradual transitions." This truth, which has so profoundly modified the idea of a "species" entertained by pre-evolutionary naturalists—though it is but slowly, too slowly, pushing its way into the writings of pure systematists—will now be seen to be applicable to every morphological proposition.

The formation of organic beings commences with the famous "physiological units" which we have previously seen to be necessitated by the phenomena of genesis. These differ from the nitrogenous colloidal molecules of which organic matter is ultimately composed, only in being more complex, and consequently exhibiting greater sensitiveness

* Transactions of the Birmingham Natural History and Microscopical Society.

to their environment. An aggregation of them, necessarily a minute one at first, would possess still greater mobility, and show the first gleam of what we call "vitality." It would be, in fact, a speck of protoplasm, such as we know to exist (MONERA, *Protomyxa*), manifesting some of the phenomena of life, but as yet possessing no appreciable organisation.

Small as it is, the incident forces must act unequally upon the units of which it is composed. Differentiation begins; some of them take upon themselves the duty of protecting the others, and become modified for that purpose, this being obviously an advantage as the life of the aggregate is thereby rendered more secure. This aggregate we name a *cell*, and we thus arrive at the stage of the unicellular organisms which have been called Protophyta and Protozoa. Of the former Bacteria, Protococcus, and the simpler Diatoms and Desmids are progressively more complex examples.

It will be observed here that no account is taken of the development of the cell-nucleus, and it might be supposed that without this no explanation of the gradual evolution of organisms could be complete. But the fact is that a "cell-nucleus" (however important may be and is the part which it plays in the more highly developed plants) is at first nothing more than a slightly condensed portion of the protoplasm and exerts hardly any influence upon the life of the elementary organisms in which it occurs. We find protoplasm with or without a nucleus, and with or without a cell-wall; thus giving four states of existence. It may be an advantage to restrict the term "cell" to those cases where a wall and a nucleus are both present, but there is at first no distinction of importance between these cells and the "cytodes" which have a wall, but no nucleus; and in higher organisms many structures are loosely called "cells," which neither have nor have had a nucleus. Those nuclei which are now known to perform such prominent and mysterious functions are but the highest terms [illegible] gradual series of developments.

Let us now pause to check our hypothesis. If the mode indicated in the previous paragraphs be that in which the present organic world began, and if all organisms of higher structure be the descendants of ancestors resembling those just described, the doctrines of Inheritance and Reversion (which, be it remembered, are established by pure observation) will lead us to expect two things:—(1) That cells will play a conspicuous part in the structure of these higher organisms; and (2) that parts of them will be occasionally constructed directly from protoplasm that has not been formed previously

into cells. This is just what we do find; moreover, every individual, however complex, if produced by gamogenesis, is at first but a simple cell, and naked protoplasm is sometimes found to enter into the life-history of organisms otherwise highly developed.

A unicellular organism is an aggregate of the first order. These are mostly of small size; but some such, as among Algæ, Codium, Bryopsis and Botrydium,* and among Fungi, Mucor and Peronospora,* reach a considerable size. The first step towards an aggregate of the second order is manifested in the fact that, in some unicellular organisms that multiply by simple fission or budding, the daughter-cells remain for a time attached to each other, or to the parent cell, instead of separating, as others do, at once. The Diatoms furnish an instructive series. Some, such as Bacillaria, simply slide upon one another's longer edge in an irregular fashion; others, as Isthmia, remain attached by the corners only; while some remain permanently connected into more or less tree-like forms. The Desmidieæ furnish a somewhat similar series of more and more perfect aggregation. In Yeast, again, we have an instance where cells continue in contact with one another, although so slight and immaterial is the union that the slightest force suffices to break it. In Sarcina and in most Confervæ we find a greater coherence of the component cells and a greater degree of individuation of the compound. The same type is still further developed and completed under various forms and by various methods in the Lichens, the Mushrooms, and the higher Algæ. A perfect instance of a spherical aggregate of the second order is furnished by Volvox, where the cells are united in a definite form and mass of only one degree of composition, so long as it is not engaged in the process of multiplication.

Thus cells, which are aggregates of the first order, are compounded into fronds or *thalli*, which are aggregates of the second order. Each cell of the thallus has lost its individuality and become merely a part of a whole; that is to say, it is integrated with others, and its life is merged in the life of the compound. But still there is no sudden transition; a complete series can be traced from loose fortuitous aggregations of cells, like those of yeast, up to the final and complete integration which constitutes the frond of a Laminaria. Those branches of the vegetable kingdom which are predominantly of the second order of aggregation are called Thallogens or Thallophyta.

* These are what are called in the text Hydrogastrum and Botrytis respectively. What is now known as Botrytis is not a unicellular fungus.

The transition to aggregates of the third order proceeds in the same unobtrusive manner. The variously formed outgrowths from the sides of a frond of *Rhodymenia palmata* exhibit the beginning of such a tendency, which becomes more marked in *Delesseria sanguinea;* but the sea-weeds, though nearly approaching it, do not present us anywhere with a complete tertiary aggregate. This we shall meet with first among the Jungermanniaceæ, as, for instance, in *J. asplenioides*, and more decided examples are abundant in the ordinary type of Mosses. Take the common *Hypnum triquetrum;* we see a definite erect stem, regularly furnished with foliar expansions each of which presents the characters of a perfect aggregate of the second order, and these by their definite subordination to the stem make the whole a compound individual of the next highest order. The groups in which this is predominant form the classes called Acrogens or Cormophyta.

So far we have considered only the cryptogams. The extension of the theory to the Phænogams, and some important deductions from it, form the subject of the next chapter.

THE MIDDLE LIAS OF NORTHAMPTONSHIRE.

BY BEEBY THOMPSON, F.G.S., F.C.S

PART II.
Palæontology.

(*Continued from page 122.*)

In drawing up the list of fossils below, I have consulted the following works and papers; and where the record is of a form I have not found myself the authority for it is quoted.

1860.—Aveline, W. T., and Trench, Richard. Geology of parts of Northamptonshire. Memoirs of Geological Survey. (Description of quarter sheet, No. 53, S.E.)

1861.—Aveline, W. T. Geology of parts of Northamptonshire and Warwickshire. Memoirs of Geological Survey. (Sheet, No. 53, N.E.)

1872.—Beesley, Thos. A Sketch of the Geology of the neighbourhood of Banbury. Paper read at the annual meeting of the Warwickshire Naturalists' and Archæologists' Field Club, March 5, 1872.

1875.—Judd, Prof. J. W. The Geology of Rutland, and parts of Lincoln, Leicester, Northampton, Huntingdon, and Cambridge. Memoirs of Geological Survey.

1877.—Tomes, R. F. On the Stratigraphical Position of the Corals of the Lias of the Midland and Western Counties of England and of South Wales. "Quarterly Journal of Geological Society."

1879.—Walford, Edwin A. On some Middle and Upper Lias beds in the neighbourhood of Banbury. From Proceedings of the Warwickshire Naturalists' and Archæologists' Field Club.

1883.—Walford, E. A. Notes on some Fossils from the Transition-bed between the Middle and Upper Lias of Northamptonshire. "Journal of the Northamptonshire Natural History Society."

Davidson, Dr. T. A Monograph of the British Fossil Brachiopoda. Palæontographical Society. Various years.

Thompson, B. Notes on Local Geology. "Journal of the Northamptonshire Natural History Society." Various papers. 1881-3.

List of Fossils from the Middle Lias of Northamptonshire.

Name.	Authority.	Margaritatus Zone.	Spinatus Zone.	Transition Bed.
Reptilia.				
Teleosaurus (?) vertebra	Walford			×
Ichthyosaurus vertebræ and teeth		×	×	
,, coprolites	Beesley	×		
Pisces.				
Hybodus spine	Walford		×	×
Fish remains (vertebræ, scales, teeth)		×	×	×
Cephalopoda.				
Amaltheus margaritatus, *Mont.*		×	×	
,, Engelhardti, *d'Orb*	Beesley	×		
,, spinatus, *Brug.*			—	
Phylloceras heterophyllum, *Sow.*				×
Stephanoceras annulatum, *Sow.*				×
,, commune, *Sow,*			×	×
,, Holandrei, *d'Orb*				×
,, crassum, *Y. & B.*			×	
,, subarmatum, *Y. & B.*	Walford			×
,, fonticulum, *Simp.*	Walford			×
Harpoceras cæcilia, *Rein*				×
,, Normanianum, *d'Orb*	Geol. Survey		×	
,, serpentinum, *Rein*				×
,, acutum, *Tate*			×	×
Nautilus striatus (?), *Sow.*	Walford			×
,, semistriatus, *d'Orb*	Beesley		×	
,, truncatus, *Sow.*	Beesley		×	
,, obesus, *Sow.*			×	
Belemnites clavatus, *Blain*	Beesley	×		
,, apicicurvatus, *Blain*		×		
,, cylindricus, *Simp.*	Walford			×
,, breviformis, *Voltz*	Beesley		×	
,, paxillosus, *Schl.*		×	×	

Name.	Authority.	Margaritatus Zone.	Spinatus Zone.	Transition Bed.
Belemnites Brugierii, *d'Orb*	Beesley, Geol. Sur.		×	
,, subaduncatus, *Voltz*	Walford			×
,, tripartitus, *Schl.*	Beesley, Walford		×	×
,, elongatus, *Sow.*			×	
,, Fournelianus, *d'Orb*	Beesley		×	
,, sp. (?)		×	×	×
GASTEROPODA.				
Dentalium elongatum, *Münst.*	Walford			×
,, liassicum, *Moore*				×
Nerita sp. (?)				×
Cryptænia expansa, *Sow.*		×		×
,, consobrina, *Tate*			×	×
,, solarioides, *Sow.*				×
,, rostelliformis, *Dunker*	Beesley	×		
Pleurotomaria heliciformis, *Desl.*			×	×
,, helicinoides, *Röm.*				×
,, rustica, *Desl.*	Walford			×
,, Hierlatzensis, *Hornes.*				×
,, similis, *Sow.*	Beesley		×	
,, Anglica, *Sow.*	Geol. Survey		×	
,, liasina	Beesley		×	
,, complanata, *Desl.*	Beesley	×		
,, araneosa, *Desl.*				×
Discohelix aratus, *Tate*	Beesley	×		
,, Dunkeri, *Moore*, var.	Beesley		×	
Trochus Pandion, *Dumort*	Walford			×
,, Thetis, *Dumort*				×
,, Pluto, *Dumort*	Walford			×
,, Ariel, *Dumort* (? lineatus, *Moore*)				×
,, Pethertonensis, *Moore*				×
,, Mysis, *d'Orb*; near to				×
,, rotulus, *Stol.*	Walford			×
,, nodulatus, *Moore*			×	
,, glaber, *Quenst.* (?)				×
,, carinatus	Beesley		×	
,, concinnus	Beesley		×	
,, Gaudryanus, *d'Orb*				×
,, ,, var.	Walford			×
,, Æolus, *d'Orb* and var.	Walford			×
,, Deschampsii, *d'Orb* (?)				×
,, similis, *Moore* (?)				×
Phasianella turbinata, *Stol.*				×
Pitonillus sordidus, *Tate*			×	
Turbo lineatus, *Moore*				×
,, cyclostoma, *Benz.*		×		×
,, aciculus, *Stol.*		×		×
,, linctus, *Moore* = Turbo nudus, *Moore*		× (?)		×
,, varians, *Moore*	Walford			×
,, Lucilius, *Dumort*	Walford			×
,, bullatus, *Moore*	Walford			×
,, elegantissimus, *Moore*				×
,, Rutteri, *Moore*				×
Eucyclus Nireus, *d'Orb*	Walford			×
,, conspersus, *Tate*				×

Name.	Authority.	Margaritatus Zone.	Spinatus Zone.	Transition Bed.
Litorina biornata, *Tate*	Walford			×
Turritella Dunkeri, *Terq.*	Walford			×
,, Juliano, *Dumort*	Walford			×
Cerithium liassicum, *Moore*				×
,, reticulatum, *Desl.*				×
,, confusum, *Tate*				×
,, ferreum, *Tate*				×
,, Moorei, *Tate*	Walford			×
,, asperulum, *Moore*				×
,, varicosum, *Moore* (?)	Walford			×
,, coronatum, *Moore* (?)	Walford			×
,, Ilminsterense, *Moore*				×
Chemnitzia foveolata, *Tate*				×
,, semitecta, *Tate*				×
,, undulata, *Ziet.*	Walford			×
Actæonina Ilminsterensis, *Moore*			×	×
Cylindrites Whitfieldi, *Moore*				×
Orthostoma fontis, *Dumort* (?)		×		×
*Nerinea liassica, *Moore*				×
Alaria unispinosa, Moore				×

(To be continued.)

METEOROLOGICAL NOTES.—June, 1886.

The mercurial column was rather unsteady during the month, but the changes in barometric pressure were generally slight, the extreme range being only 0·591 of an inch. The highest reading, 30·297 inches, occurred on the 30th, the lowest, 29·706 inches, on the 12th. The mean pressure was rather lower than that of June, 1885. Temperature was about $2\frac{1}{2}$ degrees below the average. The former and latter portions of the month were warmer than the middle. The highest maxima were 81·0° at Henley-in-Arden, on the 29th; 78·3° at Loughborough, on the 28th; 75·1° at Hodsock, on the 29th; and 73·3° at Coston Rectory, on the 28th. In the rays of the sun, 134·5° at Hodsock, and 132·1° at Loughborough, on the 30th. The maximum (sheltered thermometer) was below 60° on seven days at Loughborough; while the mean of maximum readings was 2·6° lower than that of June, 1886. The lowest readings were 34·3° at Coston Rectory; 35·0° at Hodsock,and 37·3° at Loughborough, on the 4th; and 39.0° at Henley-in-Arden, on the 5th. On the grass, the thermometer recorded 31·5° at Hodsock, and 35·5° at Loughborough, on the 4th. Rainfall was decidedly below the average, the total values being 0·74 of an inch at Hodsock; 1·18 inches at Henley-in-Arden; 1·36 inches at Coston Rectory; and 1·56 inches at Loughborough. The heaviest falls, ranging from 0·98 to 0·37, were on the 1st, and the number of "rainy days" varied from eight to thirteen. Thunderstorms occurred at Coston Rectory and Loughborough on the 1st, and at Henley-in-Arden on the 19th. Sunshine was deficient. The wind was generally light, and its prevalent direction from westward. Harvest operations were much retarded, and vegetation suffered from the cold drought.

Wm. Berridge, F. R. Met. Soc.

12, Victoria Street, Loughborough.

* It appears that this is not a Nerinea, but until a new name has been assigned to it I retain the one by which it has for a long time been known.

Natural History Notes.

Epiphytal Plants.—On Saturday afternoon, when botanising at Churchill, Worcestershire, I noticed an unusual number of plants growing high up on pollard willows and other trees. Thus on one willow were common nettle, hawthorn, a willow herb, probably *hirsutum*, and the Wood Betony. Upon another willow I found a young ash tree, an alder, and a small willow herb. Again, upon one tree were a small filbert tree and a hawthorn; while a wild raspberry occurred on one tree, and also a young gooseberry bush side by side with another young ash. Several tufts of grass were growing on the trees, but there seemed very little soil or decayed vegetation up where these plants were nourished, though the spot was very damp from an adjoining brook and marshy ground, in which latter I was glad to find *Mimulus luteus* at one spot, a long way from any cottages.—Horace Pearce, F.L.S., Stourbridge.

Students' Garden, Cannon Hill Park.—In a note to a very interesting paper on the Flora of the Rea Valley, which appeared in the June number of the "Midland Naturalist," the writer, the Rev. H. Boyden, refers to this garden, and makes two suggestions, which he will be pleased to hear have not been overlooked. As soon as the site of the garden was decided upon I saw that the pool adjoining would form a very valuable adjunct, and that not only aquatic but possibly also marsh and bog plants might be grown there. Accordingly a series of "pockets" have been constructed around the margin of the pool, and these, as well as the "bays" between them, will, I hope, soon be stocked with water-loving plants. The naming of the trees and shrubs, too, was a part of my original suggestion to the Park Committee, and the labels are in course of preparation. They will give the botanical and common names, together with the natural order and the countries of which the tree or shrub is native, so that while helpful to the student of botany it is hoped that they may also prove instructive and interesting to the general visitor.—Joseph W. Oliver.

Ellesmere Excursion.—On Wednesday, June 23rd, I joined the botanical excursion of the Midland Union to Blakemere, Colemere, Crosemere, and Ellesmere meres. It was a bright, sunshiny day, though rather too windy for examining the more exposed meres. I had but a short time for collecting, but the list of micro-organisms, etc., that I recognised, which is subjoined, shows that there is a very good field for further study there. The most interesting find was *Melicerta Janus*, which had not been previously found in England, having been found first in Scotland by Mr. John Hood. Frog-bit (*Hydrocharis morsus-ranæ*), bladder-wort (*Utricularia vulgaris*), water-milfoil (*Myriophyllum spicatum*), horn-wort (*Ceratophyllum demersum*), *Fontinalis antipyretica*, *Chara*, *Nitella* (in fructification), *Bulbochæte*, *Rivularia angulosa*, *Volvox Globator*, *Docidium nodulosum*, *Pediastrum Boryanum*, *Planorbis crista*, *Daphnia mucronata*, *Moina rectirostris*, *Polyphemus pediculus*, *Sida crystallina*, *Camptocercus rectirostris*, *Nais proboscidea*, *Tathrocampa annulosa*, *Floscularia cornuta*, *Stephanoceros Eichhornii*, *Melicerta ringens*, *Melicerta Janus*, *Œcistes crystallinus*, *Notommata aurita*, *Forficula ensifera*, *Asplanchna priodonta*, *Rotifer macroceros*, *Rotifer vulgaris*, *Salpina mucronata*, *Pterodina patina*, *Metopidia acuminata*, *Euchlanis triquetra*, *Hydra vulgaris*, *Ophrydium sessile*, *Spongomonas intestinalis*, *Centropyxis aculeata*.—Thomas Bolton.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—Geological Section, June 29th. Thos. Waller, Esq., B.A., B.Sc., in the chair. Exhibits:—Mr. Bolton, (1) *Melicerta Janus*, a rotifer found in one of the Shropshire Meres at one of the excursions of the Midland Union of Natural History Societies on Wednesday last. The rotifer had previously been found only in Scotland by Mr. Hood. (2) A few live specimens from Tenby, including (*a*) *Noctiluca miliaris*, (*b*) The Beroe, (*c*) The beautiful Clavelina, (*d*) Larval Crabs, (*e*) *Spirorbis nautiloides*. Mr. Hughes for Mr. Walliker, crystals of salt and stratified salt from cistern at Middlesbrough Salt Works; also, for Professor Lapworth, rock salt from Middlesbrough; also, for comparison, crystals of salt from Lake Utah; also, models in wood of the cubic forms of crystals, nearly fifty in number, in many varieties of facetting. Mr. J. E. Bagnall, for Mr. W. R. Hughes, *Cynoglossum officinale*, *Orchis ustulata*, *Helianthemum vulgare*, *Anthyllis vulneraria*, *Polygala depressa*, and other rare plants from the oolite soils of Cheltenham. Mr. Madeley, of Dudley, *Labechia conferta*, *Heliolites interstincta*, *Halysites catenularius*, *Heliolites megastoma*, *Favosites Forbesi*, *Favositella interpuncta*, *Favosites Hisingeri*, *Stromatopora typica*, *S. Carteri*, *S. concentrica*, *S. discoidea*, *Clathrodictyon vesiculosum*, *C. fastigiatum*, *C. variolare*, *C. striatella*, *Favosites Gothlandica*, *F. Bowerbanki*, *Heliopa cærulea* (recent), *Pocillopora* (recent), *Callopora Fletcheri*, *Monticulipora pulchella*. Mr. J. E. Bagnall, *Nardus stricta*, *Carex pulicaris*, *Carex binervis*, *Myosotis collina*, *Scirpus fluitans*, all new to Stour basin, from near Walford. Mr. Madeley read a most interesting and instructive paper on Stromatopora. A hearty vote of thanks was given to Mr. Madeley at the close of the paper.—General Meeting, July 6th. Mr. H. T. Hassall in the chair. Mr. W. H. Wilkinson exhibited a specimen of *Chrysanthemum leucanthemum* (the great Ox-eye Daisy), in which the flower was a union of three flower heads, and the stem was fasciated. He also exhibited the following lichens, sent by Mr. W. B. Grove, B.A.:—*Lecanora ventosa*, *forma lepadolemma*; *Lecidea contigua*, *forma limitata*; *Lecidea geographica*, *forma contigua*; *Graphis scripta*, from Cader Idris; also *Umbilicaria cylindrica*, from Arran Mowddy.—Microscopical and General Meeting, July 20th. Mr. J. E. Bagnall, A.L.S., exhibited *Symphytum officinale*, *Rhamnus catharticus*, *Potamogeton flabellatus*, *Geranium pratense*, and *Melilotus officinalis*, all from Halford, Stour basin; also, *Epilobium roseum*, from Aston. Mr. Bagnall also exhibited, from Rev. H. P. Reader, *Cephalanthera rubra*, from Gloucestershire, and a collection of mosses, amongst which were the following:—*Brachythecium glareosum* and *Hylocomium loreum*, also from Gloucestershire.—Geological Section, July 27th. Thos. Waller, Esq., B.A., B.Sc., in the chair. Exhibits: Mr. Wilkinson, a pink proliferous rose, in which the second bud was supported on a stem an inch long from the centre of the larger rose, from Handsworth. Mr. Morley, Dendrites on a stone from Pennsylvania. Mr. Waller gave his promised lecture on granites (illustrated by fine specimens of typical and other granites, and a large series of micro-sections), which was fully appreciated by a good attendance of members and friends.

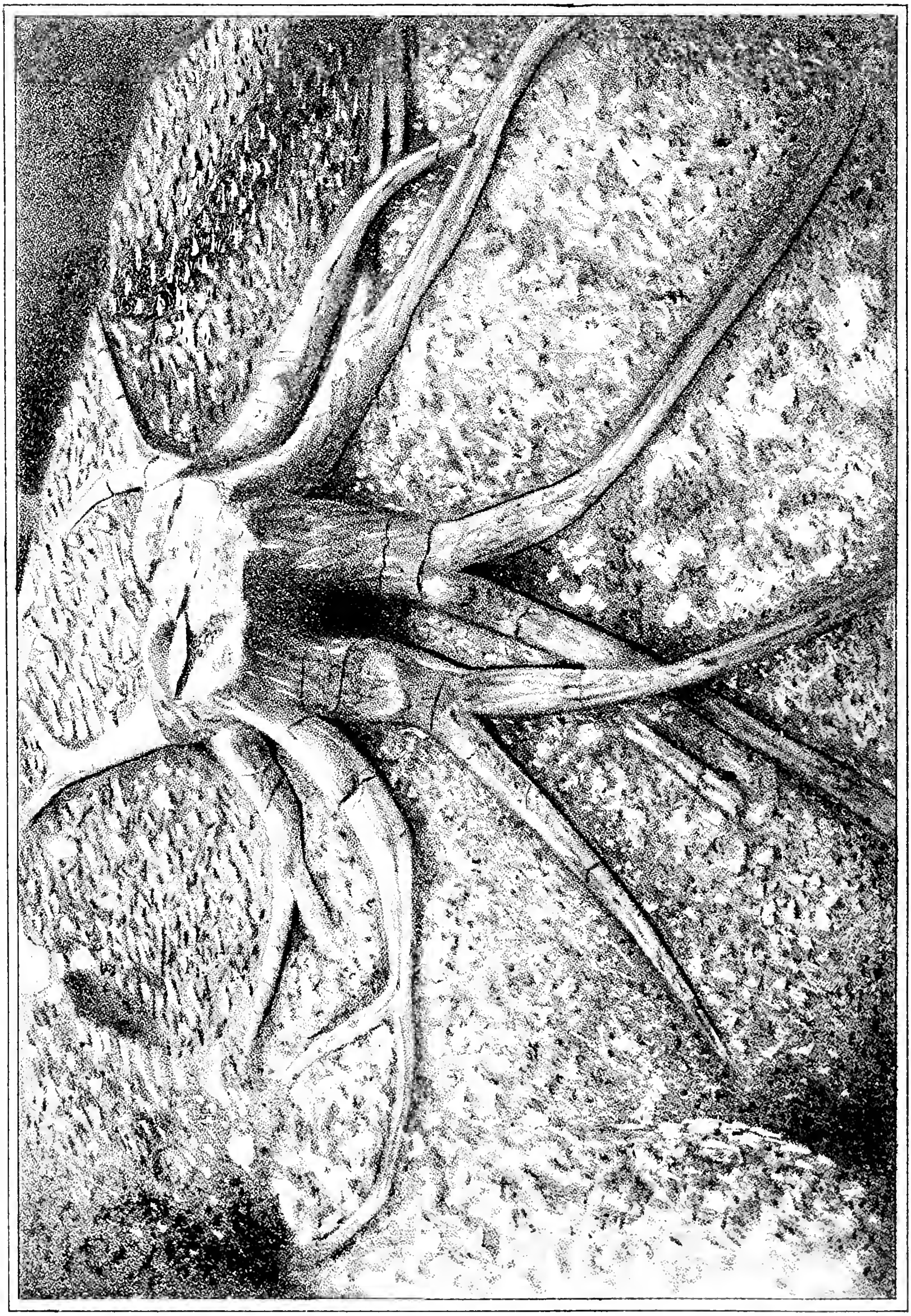
BIRMINGHAM MICROSCOPISTS' AND NATURALISTS' UNION.—June 21st. Mr. H. Insley showed specimens of *Cotyledon umbilicus* and *Saxifraga tridactylites*, from Maxstoke; Mr. J. Madison, a collection of land and freshwater shells, made during a visit to Scotland, including specimens of *Linnæa peregra*, var. *Burnetti*, from Loch Skene, so far its only habitat; Mr. C. P. Neville, *Trigonia costata*, *T. incurva*, and other fossils, from Portland; Mr. H. Hawkes, specimens of *Thalictrum alpinum*, *Saxifraga nivalis*, *Lycopodium alpinum*, and *L. annotinum*, from Snowdon; Mr. A. T. Evans, fossiliferous pebbles from the drift, containing *Cyathophyllum*, *Atrypa*, and *Orthis*. Mr. C. F. Beale, a complex thorn of *Univaria procumbus*, from South Africa. Under the microscopes: Mr. Mulliss, leg of mining bee, with pollen; Mr. H. Hawkes, section of stem and fruit of *Lycopodium alpinum;* Mr. J. W. Neville, larvæ of an Australian tettigonia, found on the eucalyptus tree.—June 28th. Mr. Deakin exhibited a specimen of English adder; Mr. J. Madison, a collection of land and fresh-water shells from the Continent; Mr. Jerome Harrison, jun., a Palæolithic implement from a gravel bed in the north of France, and two of neolithic age from Loughborough, and the peat beds, Denmark; Mr. Corbet, a spider crab, *Maia squinado*. Under the microscope: Mr. J. W. Neville, leaf of an Australian sundew, with captive insects; Mr. H. Hawkes, a section of dock, showing the natural colouring. A paper was read by Mr. C. F. Beale, on "Ancient Flint and Stone Implements." The writer said it would be impossible to find a use for all the implements that had been found. They were classed in two sections, the Palæolithic and Neolithic. The former were almost always made of flint, and were associated with the remains of the mammoth; the latter were made of all kinds of material, from sandstone to jasper, obsidian, and chalcedony, and were associated with the remains of animals found living at the present time. Arrow heads were of three kinds—triangular, lozenge, and leaf-shaped, sometimes finished with serrated edges. Stone hammers were either grooved or bored, when they were fixed to the handle either by thongs or in the ordinary way. The writer called attention to the strong resemblance between stone implements from different parts of the world, and the superstitions that had surrounded them from the earliest times, and concluded by expressing a hope that members would use their eyes in this neighbourhood, that some of these interesting relics might be brought to light. The paper was illustrated by a large assortment of implements of different kinds, from roughly chipped to highly finished specimens, and some were contrasted with spurious ones—the work of "Flint Jack."—July 5th. Mr. C. P. Neville exhibited a specimen of the long-eared bat, *Plecotus auritus;* Mr. Deakin, *Trichobasis suaveolens* and *Puccinia variabilis;* Mr. Corbet, *Uromyces ulmariæ;* Mr. J. W. Neville, *Helix erronea* and *H. rivolii*, from Ceylon.—July 12th. Mr. A. T. Evans showed cast of a calymene, amethystine quartz, &c., in pebbles from the Moseley drift; Mr. J. Madison, specimens of *Limnæa stagnalis*, var. *fragilis variegata*, from Malham Tarn; Mr. J. Harrison, jun., skull of a Siluroid fish, *Doras maculatus*, from South America. Under the microscopes: Mr. Wagstaff, a new annelid, *Nais Hamata*, from Sutton Park; Mr. Mulliss, palate of *Trochus zizyphinus*. Mr. Sanderson then read a paper on "Birds I have met with in the Yorkshire Dales." The writer described the fauna as very different from that of the Midlands, and gave a list of birds common with us yet only rarely met with in Yorkshire. Lists were given of the various species, with notes of observations on them, the writer regretting that birds adding so much to the beauty of the solitude as the raven and heron, should be constantly sacrificed by the gamekeeper, the former to grouse, the latter to trout.

LEICESTER LITERARY AND PHILOSOPHICAL SOCIETY.—SECTION D, ZOOLOGY AND BOTANY. Chairman, F. T. Mott, F.R.G.S. Monthly Meeting, Wednesday, July 21. Attendance, 6 (2 ladies). Three new members were elected, viz.: Mr. W. H. Winterton, Miss Sloane, and Miss Mary Sloane. The Chairman reported that at the Field-day Excursion last week only three members attended. They went by rail to Elmsthorpe, and walked by Burbage Wood and Common to Hinckley. In the pond in which *Utricularia vulgaris* was found several years ago they found the plant still abundant, but not in flower. In a pond in Burbage Wood, *Equisetum limosum*, variety *fluviatile*, was found in its extreme and most typical form. The following objects were exhibited, viz.: By Mr. and Miss Grundy, growing plants of *Drosera rotundifolia*, *Anagallis tenella*, *Botrychium lunaria*, *Sphagnum cymbifolium* in fruit, all from North Wales; also a piece of heart-wood from a very large decaying yew tree, said to be 900 years old, growing in the same district, the annual rings of wood being plainly visible and about one-eighth of an inch in thickness, indicating an increase of about one foot diameter in fifty years during the period of vigorous growth. By Dr. Finch, fresh specimens of *Colchicum autumnale* in fruit, the length of the stem from the corm to the capsule being just one foot, the capsule itself 1½ inch, and the decaying leaves one foot long. By the Chairman, a specimen of the moth, *Abraxas ulmata*, taken in Burbage Wood. The Chairman read a paper on "The hairless condition of the human skin," arguing against Darwin's theory that it has been produced by sexual selection.

PETERBOROUGH NATURAL HISTORY, SCIENTIFIC, AND ARCHÆOLOGICAL SOCIETY.—June 15th. ANNUAL MEETING.—Mr. E. Wheeler in the chair. Report read and officers elected: president, the Very Rev. the Dean of Peterborough; secretary and treasurer, Mr. J. W. Bodger.—June 17th. Botanical ramble, conductor Mr. J. W. Bodger, from gravel walk by Low Farm and tan yard, along Roman bank eastward. Plants collected, *Sagina apetala*, *Malachium aquaticum*, *Barbarea vulgaris*, *Geranium molle*, *G. dissectum*, *Senebiera coronopus*, *Conium maculatum*, *Torilis nodosa*, *Cicuta virosa*, *Callitriche verna*, *Pryonia dioica*, *Solanum dulcamara*, *Veronica beccabunga; Holcus mollis*, *Alopecurus geniculatus*, &c., &c.—June 24th. Geological excursion to Hetton Brickfields, Oxford Clay section. Among fossils obtained were teeth of *Acrodus nobilis*, *Belemnites puzosianus*, one having the phragmacone chamber filled with the clay, and containing two small bivalves pyritized *(Nucula?)*, *Avicula inæquivalvis*, *Trigonia gibbosa*, *Serpula vertebralis*, and *Ceritheum*.—July 1st. Botanical ramble by North Bank; plants collected—*Chelidonium majus*, *Ranunculus circinatus*, *R. fluitans*, *R. heterophyllus*, *Iris pseudo-acones*, *Hottonia palustris*, *Scrophularia aquatica*, *Spargarium ramosum*, *Alisma plantago*, *Convolvulus sepium*, and others.—July 8th. Excursion to Cambridge, conducted by Dr. W. Easby. The Fitzwilliam and Antiquarian Museums were visited, under the direction of the Rev. L. S. Lewis, M.A., and Dr. Waldstein, the latter gentleman giving an informal address on some of the treasures exhibited; Mr. Lewis taking charge of the party. The Chapel and Hall of Peterhouse were explored, also the libraries of Corpus Christi, Trinity, and St. John's Colleges, so rich in rare and illuminated manuscripts. The tower of St. John's was ascended, from the top of which a splendid panoramic view of Cambridge and the surrounding country was obtained. Magdalen and King's Colleges were also visited, the party returning to Peterborough highly pleased with so delightful an outing. Geological excursion the same evening, under the guidance of Mr. E. Wheeler, to Oxford Clay section at Fletton.

Plate III

A FOSSIL TREE.



Herald Press Lith Bam.

A FOSSIL TREE AT CLAYTON, YORKSHIRE.

BY W. S. GRESLEY, F.G.S.

As it is very rarely that an opportunity offers of seeing and (for those who wish it) examining a really good specimen of the remains of a fossil tree *in situ*, it has occurred to me that a short description of what is undoubtedly the finest or most perfect example of a fossil of this description hitherto discovered in Great Britain, if not in the world, would be interesting to readers of this magazine.

Most of us probably will be unable to pay the fossil a visit, but I can assure those who are particularly interested in fossil botany, and in the question of the formation of coal, that an inspection of it will amply repay them for undertaking the journey. I am informed that the owner of this unique object is not likely to allow it to be removed from its natural position; at all events for the present.

Locality. About three miles to the south-west of Bradford, and about four to the north-east of Halifax, at the Fall Top Quarries at Clayton, which are worked by Messrs. J. Murgatroyd and Son. The situation is high up on the hills (perhaps 600 or 700 feet above sea level), but is within ten minutes' walk from either the Clayton or the Queenberry Railway Stations on the Great Northern Line (Bradford and Halifax section).

Geological Horizon. The fossil tree occurs in the sandy shales of the Lower Coal Measures or Ganister series; in beds which overlie the Elland Flagrock, a well-defined and persistent geological boundary, dividing the Lower Coal Measures into two distinct parts; the upper embraces the strata beneath the Silkstone or Blocking Coal; the lower, the measures containing the Halifax Hard and Soft Coals. The quarry is wrought for landings, flags, building, paving, and roofing slabs, and it was whilst removing the "baring" that the fossil was discovered. The strata dip about 1 in 10 to the south-east. The bed containing the specimen is a bluish-grey micaceous sandy shale, containing numerous fossil roots, and here and there streaks of coaly matter. It occurred about twelve feet beneath the surface and nearly the whole of the covering has been carefully removed so as to completely expose the whole of the fossil with the exception of the extremities of one or two of the roots, which either pass downwards into the shale, or run out of sight into the face of the quarry.

Description of the Fossil Tree.—It consists of a very perfectly preserved lower end of a fossil trunk of a tree with its roots and rootlets attached thereto, and freely spreading or branching out on all sides in a natural manner (see Plate III). The specimen has all the appearance of being *in situ*, *i.e.*, of occupying the actual spot where it grew, flourished, and then died. But this of course was not upon the hill-top where it now is, but doubtless at or near the sea level in carboniferous times. That this must have been the case is evident from the character and lie of the beds of sandy material enclosing it.

The height of the tree stump, including the roots, is about four feet, and the diameter three feet nine inches. I could not learn that the stem had been noticed to extend upwards beyond what is now visible. Strictly speaking the fossil is not a "*tree*," but the *roots of one only*. These magnificent roots extend away in a gently sloping direction all round from the stump. They include an area of say fifty or sixty square yards of ground, and the average length of each root is probably about twelve feet; the largest is fifteen feet long. I consider there are four main roots, all much the same size, and placed nearly equidistant round the stump. As each main root leaves the stem it immediately divides into two, and at about six feet away from the stem each root bifurcates and extends away (without again forking) in straightish lines to its extremity. There are thus sixteen distinct extremities to the roots, derived from eight forked branches, which originally proceed from four splittings-up of the base of the tree stem. The specimen consists principally of the *Stigmaria ficoides*, and possesses its thousands of rootlets or filaments extending themselves into the shale around the roots. The well-known quincuncial or spiral arrangement of the little round scars giving attachment to the rootlets is well preserved, particularly so upon two of the roots. But the size of the sketch accompanying this notice scarcely admits of their being clearly shown. That the tree which these splendid roots supported was the *Lepidodendron* or the *Sigillaria* seems certain, and from what little can now be made out upon the exterior of the specimen I am inclined to think that it represents the latter. Palæo-botanists tell us that but little difference existed between the roots of these two widely differently marked tree trunks. The material of which the specimen at Clayton is composed is hard sandstone, a good deal impregnated with hydrous iron oxide, while the roots themselves are embedded in a comparatively soft sandy shale; and this

circumstance has enabled the owners to so successfully expose its entire form without destroying any of its substance, excepting, of course, the rootlets which came away with the shale surrounding it. One of two of the roots overlap one another, which is interesting, and there seems to be another specimen of *Stigmaria* intruding itself amongst the roots of the "fossil tree." It is unfortunate that sufficient of the stem has not been preserved so that its species could have been determined with certainty, and also that none of the actual terminals of the roots are exposed to view or preserved. I suppose the fossil may be termed an all but perfect *cast* of the base of a tree with its whole system of roots intact, for I question if any internal structure exists beyond the usual central (?) pith ring-mark so characteristic of the fossil *Stigmariæ*.

I regret my inability to describe this strange and unique fossil in correct botanical phraseology. My chief object has been to help to make it known.

It has been examined by several eminent geologists and botanists, including Prof. Williamson, of Manchester, whose monograph upon the *Stigmaria*, illustrated by a very exquisite series of plates (which by his kindness I have had the good fortune to look over) for the forthcoming volume of the Palæontographical Society, in which no doubt he will refer to the Clayton *find*, will be very anxiously awaited. I may say that the price of each annual volume of this most beautifully got-up work is only a sovereign. One large quarto volume is issued yearly.

Enquiries for this book should be addressed to the Rev. Thomas Wiltshire, M.A., F.G.S., 25, Granville Park, Lewisham, S.E. Photographs of the "Fossil Tree" have been taken by two people, namely, for Mr. Davis, F.G.S., of Chevinedge, near Halifax, by E. Wormald, Great George Street, Leeds; and by J. Exley, of Southfield Lane, Great Horton, near Bradford, of whom the following can be purchased:—

(*a.*) *Fossil Tree* from edge of quarry, size about 14″ × 12″. Price 3s. 6d. each.

(*b.*) *Fossil Tree*, same view, cabinet size, at 1s. each.

(*c.*) *Fossil Tree*, nearly same view, with *a root* partly displaced before restoring to natural position, cabinet size, 1s. each.

(*d.*) *Fossil Tree* and general view of quarry and surroundings, cabinet size, 1s. each.

I need scarcely add that to see the fossil in its freshly exposed state, and whilst it is still in its natural position, a visit to Clayton should not be delayed.

Should the specimen be taken away, it is to be sincerely hoped that it will be secured for our Natural History collection (British Museum, South Kensington), where it would vastly enrich a collection, I am sorry to say, at present either greatly behindhand in possessing itself of good typical coal-flora fossils of this description, or at all events in its exhibition and arrangement of the same.

NOTES OF AN AMERICAN TOUR.

BY W. P. MARSHALL, M.I.C.E.

(Continued from page 211.)

San Francisco, the capital of the West, stands on the shore of a large sheltered inland bay that forms a noble harbour, opening to the Pacific Ocean by a side channel that leads off at right angles and leaves the harbour quite protected from the sea. The entrance of the channel from the sea is called Golden Gate, said to be so called from the splendid golden sunsets that are seen from the hills of San Francisco, looking out over the open sea, which extends clear across to Japan at 5,000 miles distance. San Francisco is very hilly, excepting the portion alongside the water, and some of the streets are too steep for horse traffic, and only workable by the cable tramways, which were originated there, and are now very extensive.

The great Palace Hotel in San Francisco is celebrated as one of the largest in the world, and is a very fine and complete building, with a large centre court 70 feet width and 140 feet length, open to the top of the building, roofed with glass, and having galleries all round at each floor, into which the room doors open. This hotel gives a good example of the large American hotels, with the important conveniences that they contain. In the large entrance hall, besides the general business counter at which all the business of the hotel is concentrated and conveniently and promptly managed, there is the railway counter of a general ticket agent, where tickets can be obtained to every part of the country and every information is given about travelling; also a telegraph office and a railway bookstall, with the inevitable American barber's shop. Railway tickets are not got at the stations as a rule, but are obtained at a general ticket agent's office in a principal hotel or in the main street near at hand; this is a great convenience

and advantage to travellers, and the tickets can be obtained a long time previously, even available for any time during the year.

A great curiosity in San Francisco is the Chinese quarter, a portion entirely occupied by Chinese, and singularly situated in the immediate neighbourhood of the best parts of the city. The Chinese are very numerous in San Francisco, and also in many other parts of California; Chinamen do the house work in the hotels instead of chambermaids and housemaids. The Chinese are very steady, industrious, and careful, and Chinese washermen do all the washing and laundry work in California and the neighbouring States.

A sea-side place close to Golden Gate is a favourite resort of the San Francisco people, where there are the celebrated Seal Rocks; rocks near to the shore swarming with seals, which are strictly preserved as a great attraction for visitors. The climate of San Francisco is very mild and equable, free from both the cold of winter and the heat of summer.

From San Francisco a visit was paid to the Cloverdale Hot Springs and the Calistoga Petrified Forest, about 100 miles north. The Petrified Forest is a remarkable example of silicified trees, which are found lying nearly horizontal at or near the surface of the ground, and one very fine specimen of a tree is sixty feet in length and eleven feet in diameter at the base.

San Francisco is, like New York, cut off by water from the railways of the main land, which start from Oaklands on the opposite shore of the bay; and the traffic is all ferried across. Also the trains at Benicia, thirty miles distance, after starting, have to cross an inner arm of the bay, and each train is then conveyed over bodily, engine and all, by the largest ferry boat in the world; it has lines of railway running the whole length of the deck, and the first half of the train runs direct on to one line on the boat with the engine at the head, and then the second half is pushed on to a second line of railway on the deck by a pilot engine at the tail end. The pilot engine takes the voyage across with the train, and on arrival at the opposite shore, the train engine runs off with its half of the train, and the pilot engine runs after it with its second half, which is then coupled up again, and away the train goes. The whole time occupied in crossing the two miles of water and shunting the train at each side is only twenty minutes from arrival at the one side to starting from the other side.

The railway in passing eastward rises very rapidly towards the mountains, having as much as 7,000 feet rise in the first

100 miles; and at the summit level in crossing the mountain range there is a snow-shed covering in the line for as much as forty-five miles length to protect it from avalanches on the mountain side, through which the train travels for nearly two hours.

Salt Lake City was reached in two days and nights' journey from San Francisco; it lies in a fine position, a great fertile plain 4,000 feet above the sea, bounded on all sides by ranges of snow-capped mountains at distances of about 30 to 130 miles, all showing bright and near in that clear atmosphere, so that it is impossible to form any idea of their real distance. The Great Salt Lake is ten miles away from the city, and is really an inland sea seventy miles long. The water is intensely salt, and said to be seven times salter than sea water, and it gives an odd sensation of buoyancy in bathing in the lake; you cannot touch the bottom after reaching little more than four feet depth, but float about ignominiously like a cork.

Salt Lake City is a strange rambling place, with the main streets very wide, but generally only in the condition of country roads, and they have rows of trees on each side, with open running streams of water. Looking down from the high ground north of the city, the sight is very singular; a great number of the houses, large and small, stand in gardens, and only in some of the principal streets are the houses joined up together to a continuous frontage. State Road runs through the city from north to south, and extends in a continuous straight line for a length of twenty-five miles, on to the foot of the surrounding mountains. At the head of it are the great Mormon Tabernacle and their Temple, which has now been thirty years building, but has not yet got a roof on, and from all appearance may now never be finished, as Mormonism seems to have got its death-blow in the place.

From Salt Lake City a run of 600 miles through the Rocky Mountain district brought us again to Pueblo, where the out-going course of the journey was crossed. This run was of special interest, through extraordinary rock gorges, showing very fantastic forms of gigantic rocks standing up like ruined castles and fortifications; and passing over several lofty summits, one of them 11,000 feet above the sea, about the highest railway in the world. The intermediate valleys were singularly beautiful with flowers, and at one part there was something like twenty miles length of railway, with the ground on each side literally carpeted with great masses of flowers of lovely varied colours, and extending as far as the

eye could distinguish on each side of the line. It was a nearly level plain, bounded by mountain ranges at various distances, from ten to fifty miles probably; with a light sandy soil having very little grass to be seen, but covered with flowering plants in great patches. Otherwise it looked a desert, with scarcely a trace of human or animal life, and hardly any trees to be seen.

Chicago was next reached, which is the third largest city in the States, having more than 500,000 population. It is situated on the shore of Lake Michigan, one of the gigantic inland seas 70 miles across and nearly 300 miles in length, which has waves breaking on the shore and quite a rough sea sometimes. Chicago is remarkable for the rapidity with which it has been rebuilt in the fifteen years since a terrible and most destructive fire destroyed a large portion of the city, and for the handsome and substantial character of the new buildings that have been erected.

A special feature of the place is the great stock yards for cattle and pigs, and large grain warehouses, containing the largest store of both in the world; also the great manufacture of tinned meats in connection with the stock yards, and the special mode of killing the cattle by a rifle shot, the most humane and also most economical system.

The grand Niagara Falls were then visited,—"Thunder of Waters," as the name is said to mean in the Indian language,—the largest of waterfalls as regards the enormous volume of water passing over the falls, though much exceeded in height by other falls. The finest view is from the high banks on the Canadian side, where a complete view of the whole is obtained:—the great Horse-shoe Fall in front, half-a-mile width at the edge of the fall, with twenty feet thickness of water in the centre, and the American Fall beyond, a quarter-of-a-mile width, with Goat Island dividing them, and the three small Sister Islands at the extremity stretching out into the Upper Rapids. The great Whirlpool Rapids are two miles below the Falls, where the whole mass of water is forced through a narrow rocky channel, only 220 feet width. The deep indentation formed in the centre of the Horse-shoe Fall by the wearing away of the rocks is well seen in this view.

The return to New York by railway, 450 miles from Niagara, gave an illustration of American competition in railways, which is being carried on to a ruinous extent in many districts; there are two rival lines for this distance which have cut down the fares to only $\frac{1}{2}$d. per mile (1 cent per mile).

The voyage back to England was by one of the largest of the New York steamers, 8,000 tons, tearing along through the ocean at a great speed, $18\frac{1}{2}$ knots, or twenty-one miles an hour, day and night continuously, for five days of the run. The passage was exceptionally fine and quick, with bright sunshine and smooth calm sea every day but one; we left New York on Saturday morning and landed at Liverpool the next Saturday evening, including in the passage a stoppage at Queenstown to land the mails; the great steamer was like a floating castle, so substantial and firm, and full of comforts like an hotel, with electric lighting throughout.

Such was the conclusion of a most delightful and enjoyable trip, one to be remembered with great pleasure and interest.

MIDLAND UNION OF NATURAL HISTORY SOCIETIES.

ANNUAL MEETING AT SHREWSBURY, JUNE 22ND AND 23RD, 1886.

ADDRESS BY THE REV. J. D. LA TOUCHE, PRESIDENT OF THE UNION.

(Continued from page 207.)

From the subject of geology to that of archæology seems a long step, yet in fact each shades off into the other by insensible gradations. The earliest traces of man are found in the implements and works of art which he has left behind him—far more imperishable than his skeleton. These not only furnish unequivocal proofs of his presence in the remote past, but tell us something as well of the degree of intelligence at which he had arrived when he formed them. I am not aware of more than one locality in the county in which relics of this description have been found, and that is the neighbourhood of Clun. Owing to the diligence and perseverance of Mr. Luff, a very considerable number of flint arrow heads and other stone implements have there been brought to light, proving that the place must in pre-historic times have been the centre of a large population, and possibly was the site of the manufacture of these weapons. Mr. Luff informs me that on Upton Rock Hill, near Clun, he has discovered the traces of this Neolithic settlement. Refuse of pre-historic workshops are here very abundant, and a large number of flint and stone implements, beautifully executed, have turned

up, proving the ingenuity, inventive faculty, and manual dexterity of our early ancestors. Until lately no trace of polish has been discovered on these remains. In a similar settlement on the Pennine Hills, and where, as here, well-chipped implements of a very distinctive type are found, a complete absence of polish may also be noted. However, lately, on the slope of Rock Hill, a beautifully polished miniature whetstone has turned up, proving that any theory as to their age, founded on their rude character, would be erroneous. Mr. Luff has also made some interesting observations on the position of a large obelisk of basalt, and its position in relation to a stone circle N.W. of it, at a distance of 120 yards. He finds that this stone is situated nearly in a line with the point of the horizon where the sun would be seen from the circle to rise on the shortest day of the year. He has taken great pains to arrive at accurate data on this point, the result of which is that the stone lies 6deg. out of this direct line. Now since, in consequence of the precession of the equinox, the sun 8,000 years ago rose 2deg. nearer the south than at present, it would seem that, supposing the Neolithic men did at that time place this boulder in its present position for some rite connected with sun-worship, an error of only 4deg. appears to have been made by them. Mr. Lewis, who has made the orientation of out-lying stones in connection with stone circles his special study, says that absolute accuracy in this matter is very rare, and that the position of the Clun Menhir is remarkably correct. His chief conclusion is that the custom of placing these outlying stones was inherited by the Neoliths, and that they practised it not knowing its exact signification. Mr. Luff well remarks, in the note which he has been so good as to furnish me with on this subject, that we have here a thought full of mystery. Who were these original sun-worshippers? Do we here get a glimpse of the religion that affected the minds of men in those remote ages? I cannot pass from this subject without an allusion to a note I have had from Mr. Symonds, to whose eloquent lectures on geology and many kindred subjects our Field Clubs have been so often indebted, and who would have been glad to be present on this occasion but for the ill-health from which he is suffering. Mr. Symonds wishes me to draw particular attention to the evidences of the existence of man, which all late discoveries and investigations tend to confirm, at the time when the Mammoth was an inhabitant of our island, and before the Isle of Wight was separated from the mainland, and before Southampton Water and the Solent had any existence. He has, he tells me, been again

investigating the evidence for this, and is more than ever convinced that such was the case. For those who may desire to study this subject, treated in a popular form, and within short compass, I may refer to his essay on the Malvern Straits.

Coming to later times, we have the remains of the Roman city of Uriconium, which will be visited by the archæologists. A county which was the boundary of two races often engaged in hostility may be expected to abound in forts and castles. Such is the case here, and an excellent example of a gentleman's mansion of the 13th century, fortified and made suitable for defence against the wild border-tribes, will be found in Stokesay Castle, to be visited by one of the sections.

The botanical treasures of a county like Shropshire, possessing a considerable variety of soil and surface, may naturally be expected to be of much interest. But I hope that in drawing attention to these I may be excused if I observe a certain amount of caution and reserve. Geologists have this advantage over botanists—that the specimens which they rejoice in collecting are practically inexhaustible, whereas plants are, even where very abundant, easily exterminated. I have even heard grave doubts expressed whether the familiar and homely primrose is not likely to disappear from our woods and hedgerows, where it has so long gladdened the eyes and hearts of the lovers of Nature, owing to the exigencies of a certain school of political thought, and whether it might not fairly claim the *protection* which is, I believe, a prominent feature in that creed. Anyhow, one of our greatest varieties—a curious rush, called the *Scheuchzeria*,—which but some ten years ago was tolerably abundant at Bomere, is now all but extinct there, owing to the ill-advised efforts of a certain teacher in Shrewsbury School (whose name I do not know) who carried off large quantities of it to send up to London to certain professional collectors there. Acts like this justly appear to the true botanist a crime no less revolting than is the destruction of a fox to the moral sense of a Shropshire squire. I have seen a party of excursionists, most of whom cared nothing and knew nothing about botany, on being told that a rare plant might be found at a particular spot, flinging themselves like birds of prey upon the spoil, and carrying off not only sprays, but roots of it, probably to be afterwards forgotten and thrown aside, and thus in their ignorance doing an irreparable injury to science. The occurrence of rare plants opens to the naturalist an inexhaustible fund of information, not only as regards their own history, but the history of the locality where they grow, its changes of climate,

of level, &c. For example, the fact pointed out by Mr. Ball that of 1,157 species of plants characteristic of the Alps, two-thirds are found in the Carpathians, one-half in the Pyrenees, and one-fourth in the Altai, is clearly of much importance in determining the physical conditions to which those mountains have been subjected. Then, again, under what circumstances did plants like the *Astrantia major* at Stokesay, and the *Potentilla rupestris* at the Breiddens, find their way to those localities? The former is found not nearer to Britain than Central France, and yet it occurs rather abundantly in the woods over Stokesay Castle. Is it the sole survivor of an extinct flora, or has it been conveyed hither, as has been supposed by some—perhaps accidentally—in the time of the Roman occupation? I am glad to see that, at the last general meeting of the Midland Union, a vigorous effort was set on foot to check the reckless destruction of rare plants, and to co-operate with the society which has been formed in France for this special purpose.

In relation to some of the lower forms of vegetable life, much attention is being paid to them by several of our local botanists, under the stimulus of the Microscopical Society which has been formed in this town. A few years ago a committee was appointed by the Caradoc Club to obtain information upon a curious phenomenon which occurs in some of the numerous lakes of greater or less size which are situated in the north of this and the adjoining parts of the border counties. At certain seasons the water becomes extremely turbid, making it useless for household purposes, and so uncomfortable for the fish that they refuse to take any bait. The result of these investigations has been an able paper by Mr. Phillips, published in the Transactions of the Archæological Society. It soon became evident that the "breaking of the meres," as the phenomenon is termed in the district, was due to the appearance at certain seasons of minute algæ in enormous quantities. These have been fully described by Mr. Phillips, and include the following:—*Rivularia articulata*, *Anabæna circinalis*, *Cœlospherium Kützingianum*, *Dolichospermum Ralfsii*, *Aphanizomenon Flos-aquæ*. It is remarkable that while in some of these meres the breaking lasts sometimes during a considerable part of the year, in others it is much more rare, and one has never been known to break, although connected by a wide ditch with the next one, which is conspicuous for doing so. I have further to report the discovery by Mr. Beckwith of *Nitella gracilis*, an alga which had previously been recorded only for North Britain and Ireland. Mr. Phillips is devoting his attention to the fungi especially, and a list of the *Hymenomycetes* of the county has already

appeared in the Transactions of the Shropshire Archæological Society. Mr. Beacall has added many new localities for some of the rarer plants found in the county; and, lastly, to advert to an altogether different branch of natural science, I may mention that Mr. Beckwith has been publishing a very able and interesting series of papers in relation to the birds of Shropshire, giving much valuable information as to their habits and their natural history.

III.—The third and last subject which I have proposed for consideration—The Work of Charles Darwin and its Influence on Modern Science—is one which I most deeply feel would tax the powers of a much more able pen than mine. But in a town distinguished as the birthplace of so remarkable a man, and on an occasion like the present, when we are assembled to share, in however humble a degree, in the great work to which his life was devoted, it seems as if some tribute to his memory and some notice of that work were called for. From the time that, early in my life, I read Humboldt's "Cosmos" and "The Vestiges of Creation," two books which then attracted a good deal of attention, I have been much impressed with the conviction that the belief then, and even still so commonly prevalent in sudden, spasmodic, isolated acts of creation, as the means by which organised beings have from time to time appeared on this earth must ultimately be modified or abandoned, and that some account, consistent with the general laws which govern the rest of the universe, must inevitably take its place. The first of these books unfolded the sublime conception of the nebular hypothesis, whereby our solar system, as well as the myriad orbs which spangle the heavens, are shown to have been evolved from primordial matter in a state of extreme tenuity, and spread through inconceivably vast tracts of space; and the latter seemed to give a not unreasonable account of the process whereby successive generations of living beings might become modified in virtue of the conditions which surrounded them, and thus give rise to species and varieties. Besides, had not Newton revolutionised astronomy and physical science, putting to flight for ever the empiric and fanciful theories of the schoolmen? Was it unreasonable to expect that another Newton might arise to reduce the complex and mysterious phenomena of organic life to a definite system, and prove that they move onwards in obedience to laws not less distinct and unalterable? That master mind at last appeared in the person of the illustrious Darwin. It is true, indeed, that from very early times thoughts strangely similar or leading up to the theory which he has propounded have been expressed by other writers. One of the most

remarkable and wonderfully able authors of antiquity was Lucretius. His speculations seem to anticipate some of the most profound discoveries of modern times. And though, as Mr. Houghton has pointed out to me, there is no passage in his writings which can be said to shadow forth Darwin's definite explanation of the origin of created things, *i.e.*, the evolution of animals or plants by natural selection, on the contrary Lucretius frequently insists on the unchangeable nature of animals. "All things," he says, "are so constant, that the different birds, all in succession, exhibit in their body the distinctive marks of their kind; each creature has its powers defined, its boundary mark deeply set." At the same time there are some very striking and interesting passages, which shadow forth *particular points*, which bear on and are necessitated by the Darwinian explanation, especially in relation to what we now call *Teleology*, or the doctrine of final causes. He says to Memmius: "In this matter you must vehemently shun and anxiously avoid the weakness of erroneously supposing that the bright lights of the eyes are made in order that we might be able to see, and that the extremities of the shanks and thighs were attached to the feet as a base in order that we might take long steps on the road, or, moreover, that the fore-arms were fitted to the strong upper arms, and that ministering hands on each side were given in order that we might be able to perform the needful duties of life. Other explanations of a similar kind are given, but all of them put effect for cause (*præpostera*, *i.e.*, last put first) through wrong reason (*perversa ratione*), for nothing was born in the body in order that we might use it, but that which is born begets for itself a use." He elsewhere speaks of things used in accordance with the wants of life, "things made by man for the purpose of being used, as javelins, shields, beds, and cups," but records his opinion that, on the contrary, "the birth of the tongue was long anterior to language, and the ears were made before sound was heard, and in fine that all the members existed before there was any employment for them, and that they could not therefore have grown for the purpose of being used." The validity of this reasoning may appear to some in the present day as questionable and objectionable, as, doubtless, they did to the followers of Plato and Xenophon and other teachers, who laid great stress on the argument of design; but I have troubled you with a quotation from the work of an author born 100 years before our era, both for its great intrinsic interest, as well as to emphasise what appears to me to be the most distinguishing feature in the character and system of Darwin, as in his brilliant

predecessor, and that is his concentration on the simple teaching of nature, without allowing himself to be swayed one way or the other by preconceived notions and prejudices. The light which reaches us from the most distant star is the same in its nature as that which our own sun furnishes. Thus, true genius in every age, and under the most diverse conditions, moves in obedience to the same principles, and often arrives at identical results. Again, in more recent times, Lamarck, in the first year of the present century, published his profound speculations on the Origin of Species, views which were afterwards adopted and made popular by Chambers in his "Vestiges of Creation." These and others in their several lines were working towards the same end. But, after all, the theories they put forth were but speculations; most of them, and especially that of Chambers, with the defect that they presupposed successive inscrutable acts of creation; and it was long before even the most candid thinkers, such as Sir Charles Lyell, could free themselves from a view that rendered any really comprehensive generalisation possible. It was the great merit of Darwin to emancipate himself entirely from this bondage, and guided, not by the dim, uncertain light of hypothesis, or the ingenious speculations of supposed analogies, but by the teaching of careful experiment, of long-continued and patient observation, aided by a singular candour of mind, which was ever ready to listen to and weigh the strongest objections which could be urged against his views and to admit frankly all that told against them, it was reserved for a man who combined an almost childlike simplicity with a most powerful intellect to give a new departure to scientific thought, and to be the founder of a school which can alone elucidate what it is possible for us to know of the mysterious problem of life. It will not be expected that I should here attempt to give even an outline of the theory with which the name of Darwin has been identified, or to apportion the share which his predecessors had in its elaboration; though I must say, in passing, that it would be most unjust, as Mr. Hughes has pointed out in his address to the Birmingham Natural History Society, to ignore the claims of Mr. Herbert Spencer to having previously enunciated the great doctrine of evolution throughout the universe. A delightful little volume, recently published by Mr. Grant Allen, in Longman's series of English Worthies, places within the reach of any one who may desire it the history of the whole subject, as well as a clear exposition of Darwin's views and discoveries. That such an hypothesis as this should have met with bitter resistance in many quarters is not surprising, considering how opposed it was to pre-existing

opinions. Nor is such resistance to be deprecated unless it takes the form of a bigoted and blind hostility to truth. It is the ordeal whereby the newer teaching is sifted and purified from the residuum of error which must ever attach more or less to all human knowledge that is not absolutely demonstrative. But on the whole, the Darwinian hypothesis, as it is called, has been steadily gaining ground, until now, even in quarters where a few years ago it was denounced as destructive of all that men held most sacred, it is often admitted to be quite consistent with religion.

I feel that it would not be suitable to take advantage of the position which I have the honour to hold on this occasion to introduce matter which might be subject to a difference of opinion. What I have said has been with the view of emphasising what I think we shall all agree is the great object which societies, such as those which have met here this day, should place before them, and that is the steady search for truth, and a patient and reverent study of Nature, with minds unalloyed by prejudice or passion. And though it may be that the birth of truth, like that of all living things, is often accompanied with pain, let us endeavour to minimise and not increase the resistance to the reception of it, which is the cause of that pain. St. Augustine has somewhere said with a fine intuition, that it is "impossible for science to be opposed to religion." Let us not fear. It is to the free expansion of truth and the elimination of error that we owe all the blessings we now enjoy, as well as our emancipation from the bondage of ignorance and superstition. The saying of the Hebrew prophet Micah, "What doth the Lord require of thee but to do justly and to love mercy, and walk humbly with thy God," is not far in spirit from that of the heathen philosopher, Lucretius "A happy life is not possible without a clean breast." Sentiments like these are eternal, indestructible, and are independent of all science and all human knowledge.

MIDLAND UNION OF NATURAL HISTORY SOCIETIES.

A Meeting of the Management Committee was held on the 19th of August, at which the Malvern Field Club was admitted to the Union; and the invitation from the Club for the Meeting of the Union for 1887, which accompanied the application, was accepted.

The exact date was not fixed, but will no doubt be about the usual time, and Secretaries of Societies are requested to bear the Meeting in mind when arranging for Lectures, Meetings, &c.

Any Members of the Union who may have Papers or Lectures which they would be willing to deliver to other Societies in the Union are requested to communicate with the Hon. Secretary, Thos. H. Waller, 71, Gough Road, Birmingham, who will be happy to send their names to Secretaries of Societies who may signify their wish to have such Lectures delivered to them.

The completeness of the preparations for the Meeting at Shrewsbury in June, and the excellent manner in which they were carried out, makes the balance sheet, which the Local Committee who had the care of the arrangements communicated to the Meeting of the Management Committee, of considerable interest, especially to some of the Societies in small towns, as showing that the Meeting of the Union does not necessarily involve any great expense. The accounts showed that the total cost of the meeting had been about £35, and that the sale of tickets for the Conversazione and the Excursions had, within sixpence, covered this amount.

THE MONUMENTAL BRASSES OF WARWICKSHIRE.

BY E. W. BADGER, M.A.

(Continued from page 218.)

STRATFORD-ON-AVON.—*Anne [Hathaway], w. of Wm. Shakespeare*, 1623. *Haines.*

In the chancel, near the grave of Wm. Shakespeare, is a brass plate 15½in. by 7½in., with this inscription:—

HEERE LYETH INTERRED THE BODY OF ANNE WIFE
OF WILLIAM SHAKESPEARE WHO DEPTED THIS LIFE THE
6TH DAY OF AVGV. 1623 BEING OF THE AGE OF 67 YEARES

Vbera, tu mater, tu lac, vitamqu. dedisti
  Vae mihi pro tanto munere saxa dabo
Quam mallem amoueat lapidem bonus angel' ore
  Exeat Christi Corpus, imago tua.
Sed nil vota valent : venias cito Christe, resurget
  Clausa licet tumulo mater et astra petet.

The following is a rough version in Englsh :—

Thou, mother, gavest life and suck to me :
  And I, alas, give but a stone to thee.
Oh ! might some angel roll the stone away
  That thou, like Christ, might'st rise again to-day.
Vain wish : come quickly Lord, then shall she rise—
  Though now entombed—and ascend the skies.

TANWORTH. I.—*Robert Fulwode and w. Margaret.* 1531.

Unfortunately nothing remains of this brass (which is not recorded by Haines) except a group of ten children, and the following inscription (mentioned by Dugdale) upon a plate 2ft. 2in. by 3½in. :—

Orate p aĩab' Roberti fulwode Armigeri & Margarete Uxoris suae. Qui q^{i} dẽ | Robert' fuit Excellentissĩe doctrinat' siue litterat' in coĩe lege Anglie et obiit | xxº die mensis octob^{rs} Aº dni mºcccccºxxxjº cui' aĩe ppicietur deus. amen.

Translation :—

Pray for the souls of Robert Fulwode Esq., and Margaret his wife. Which Robert was excellently well learned or read in the common law of England, and died the 20th day of the month of October, A.D. 1531. Whose soul God pardon. Amen.

II.—*Margt. dau. of Simon Ralegh, Esq., and w. of Andrew Archer Esq.* 1614. *Haines.*

This is a mural brass 19in. by 13½in., now set in an oak frame. The drawing is extremely delicate and refined. The lady kneels at a prayer-desk, upon which is an open book. Upon her head is a graceful Paris hood, underneath which her hair is brushed back. Her neck is encircled by a ruff, and she wears a bodice with tight sleeves, and a plain skirt. Over these is a loose sleeveless gown of brocaded material, open in front, and arranged in graceful folds upon the tiled floor. On the lady's right is a shield of arms with tasteful mantling: ARCHER, az., three arrows, or., impaling RALEGH Arg., a cross moline, betw. twelve crosses crosslet gu. Above the arms are the crests of the two families, respectively a dragon's head arg., issuing out of a mural coronet gu., and a boar's head erect, arg.

Beneath the figure is this inscription :—

MEMORIÆ SACRVM
Margaretæ Archer filiæ Simonis Ralegh
de Farmborough Armigeri quæ fuit
mitiſſima coniux Andree Archer de
Tanworth Armigeri nec non adiutrix
pauperum et ægrotantium dum vixit quæ
obiit deci : tertio die Augusti An° 1614.

In English :—

Sacred to the memory of Margaret Archer, daughter of Simon Ralegh of Farmborough Esq., who was the most gentle wife of Andrew Archer of Tanworth Esq., and during her lifetime the helper of the sick and needy. She died the 13th day of August A.D. 1614.

There is an illustration of the brass in Dugdale.

III.—*Inscription. Anne Chambers.* 1650.

A brass plate about 16in. by 12in., now in an oak frame. At the top are engraved the crest and arms of CHAMBERS. Then follows :—

M. S. A. C.

Juxta hunc locum jacet humatum exspectans iustorum resurrectionem corpus Annæ uxoris | amantiſsimæ Johannis Chambers de Woodend hujus parochiæ generosi quæ obijt in Domino | 15° die February 1650 annoque ætatis suæ 35° unica existens filia et hæres Edwardi | Baylyes nuper de Haselor tres filios (sc̄ilt) Willūm, Edmund, et Johēm Chambers | unamque filiam nomine Elizabeth post se ex eodem marito reliquit.

Siste pedem quæso, cujus cinis estque requiras :
  Hic pietas, virtus, forma, pudorque jacet.
Virgo pudica fuit, pia conjux, almaque mater
  Quæ multo fletu conditur hoc tumulo.
Digna quidem vixiſse diu florentibus annis
  Ablata est generis spesque decusque sui.
Nondum terdenos cum quinis vixerat annos
  Parca ferox ultra cum supereſse negat.
Nil pietas virtus possunt, nil forma pudorque,
  Nil juventa potest : mors rapit omne cito.
Et nunc Anna vale ; tu terque quaterque beata es,
  Vivere cui Christo contigit atque mori.

J. C. composuit
E. C. sculpsit
W. C. dedit.

Translation :—

Sacred to the memory of Anne Chambers. Near this place lies buried the body of Anne the dearly beloved wife of John Chambers of Woodend in this parish gent. ; who departed in the Lord Feb. 15, 1650, in the 35th year of her age, being the sole surviving daughter and heiress of Edward Bayleys late of Haselor. She left behind three sons, to wit, William, Edmund and John Chambers, and one daughter Elizabeth—by the same husband.

Stay, prithee, and ask whose ashes these are : here lieth Affection, virtue, beauty, and modesty. She was a modest maid, a dutiful wife, a loving mother, who mid much 'grief is buried in this tomb. Worthy indeed to have lived to a hale old age yet she was snatched away, the hope and pride of her race. Ere she had lived thirty and five years, grim fate forbade her longer to survive. Affection, virtue avail nought, nought beauty and modesty, nor youth : death seizes everything anon. So now Anna, fare thee well : thrice, yea, four times blessed art thou whose hap it was to live and die in Christ.

John Chambers composed this.
Edmund Chambers engraved it.
William Chambers presented it.

IV.—*Inscription. Margaret Chambers*, 1666.

A plate 1ft. by $9\frac{1}{2}$in., in an oak frame, very similar to the last, but with larger and more deeply incised letters. The inscription is :—

Hic iacet corpus Margaretæ uxoris amantiſſime Edmundi
Chambers de Studley in com. Warr. Gen. filiæ et heredis
Thomæ Anderton defuncti quæ obiit 16° die Maii
Anno dom. 1666°, Annoq. ætatis suæ 30°.

Hic maneas paulum festinans quæso viator
Aspice quos cineres hæc capit urna pios.
Virtutum cultrix & relligionis amatrix
Vxor & alma parens hac tumulatur humo.
Natura poteras bene Margarita uocari
Viua ferens talem nomine & ore tuis
MARGARETA uale, tu felix terq. beata
Quæ iuſu Christi ſcandis ad aſtra poli

Translation :—

Here lieth the body of Margaret the dearly beloved wife of Edmund Chambers of Studley in the county of Warwick gent., daughter and heiress of Thomas Anderton defunct ; who died May 16, 1666, aged 30.

Pause here a little in thy haste, I pray thee, traveller: behold what pious ashes this urn doth hold. A cultivator of the virtues, a lover of religion, a fostering wife and mother is here interred. By nature thou wert well fitted to be called pearl, exhibiting it alike in name and conversation while living. Margaret, farewell: fortunate art thou and thrice blessed, since at Christ's bidding thou soarest to heaven.

V.—*Inscription. John Chambers.* 1670.

A plate 11in. by 8in., in an oak frame, very similar to Nos. III. and IV. The inscription and six elegiacs are not very deeply incised, and cannot be accurately made out from the rubbing in the writer's possession.

TYSOE. I.—*Thomas Mastrupe, priest,* 1463. *Haines.*

In the north aisle is an effigy, 14in. long, of a tonsured priest, holding a chalice, and clad in amice, chasuble, apparelled albe, maniple, and stole. (Compare the brass at Coleshill.)

Upon a plate, 16in. by 2in., is this inscription:—

Hic jacet dn̄s Thom̄s Mastrupe qud̄a capellan' isti eccē Qui obiit | xxix die mēs' novēbri A° dn̄i m°cccc°lx°iii cui' aīe ppiciet' deus amē.

Here lieth Sir Thomas Mastrupe, sometime chantry-priest of this church, who died the 29th day of the month of November, A.D. 1463. Whose soul God pardon. Amen.

II.—*Nicholas Browne and w. Jane,* 1598.

Haines has made a slight mistake in describing this brass, which lies in the north aisle near No. 1. It consists of a demi-figure of a woman, 8in. long, and a plate, 19½in. by 5in., with an inscription. The figure is similar to that of Barbara Eliot at Sutton Coldfield, the costume being a large hood, ruff, dress with tight sleeves and pointed stomacher of overlapping scales.

The inscription is as follows:—

In hoc tvmvlo condvntvr corpora Nicholai Browne et Janæ vxoris eivs, filiæ natv maximæ Roberti Gibbs de Honnington Armigeri, et Margeriæ Pridiox primæ eivs vxoris. Qvae Jana diem Obijt vndecimo die Avgvsti, Anō Domini Milesimo Qvingentesimo nonagesimo octavo.

Translation : —

In this tomb are buried the bodies of Nicholas Browne and Jane his wife, who was the eldest daughter of Robert Gibbs of Honnington Esq. and Margery Pridiox his first wife. Which Jane died on the 11th of August, A.D. 1598.

III.—*Tomizane Browne second w. of Nich. Browne* 1611.

This is not mentioned by Haines. It is a plate, 10½in. by 7½in., and lies near the last. Upon it is engraved a shield, bearing a chevron between three horses' heads couped at the neck and bridled. A similar coat is ascribed (Kittermaster's Arms, &c., of Warw.) to the family of Horsey, of Honnington.

The inscription is :

HERE LYETH THE BODY OF | TOMIZANE BROWNE SECOND | WIFE OF NICHOLAS BROWNE | WHO DECEASED Y^{E} 5 DAY OF MAY | 1611.

UFTON.—*Rich. Woddomes, parson, &c.*, 1587, *and w. Margery, with* 7 *chil. Haines.*

At the east end of the north aisle is a plate, 18in. by 16½in., engraved with the kneeling figures of a man and three sons, all in the gown so frequently described in these pages (see CHADSHUNT, BARTON, SOLIHULL II.), and a lady and four daughters. The lady has a high-crowned wide-brimmed hat, a ruff, and sleeveless gown open in front and worn over a dress with tight sleeves. The girls are similarly dressed, but wear closely-fitting caps instead of the hat. A prayer desk, upon which are two open books, separates the groups.

Beneath the figures is this inscription :—

Here lyeth the Boddyes of Richard Woddomes pars | son and pattron and vossioner of the Churche & parishe | of Oufton in the Countie of Warrike who died one | Mydsomer daye. 1587. And Margery his wiffe wth | her seven childryn as namelye Richard John & John | Anne Jone Elizabeth Ayles his iiii dawghters | whose Soule restethe with God.

"Vossioner" is supposed to mean advowson-holder.

(To be continued.)

BRITISH ASSOCIATION. — The fifty-sixth meeting commences at Birmingham on September 1st, and continues to the 8th. The President, Sir Wm. Dawson, C.M.G., M.A., LL.D., F.R.S., F.G.S., Principal of McGill College, Montreal, Canada, will deliver the Presidential Address on the evening of September 1st. The arrangements of the local committee have been carried out in a manner which will be greatly appreciated by the distinguished visitors who will attend the meeting, which bids fair to be a great success.

THE MIDDLE LIAS OF NORTHAMPTONSHIRE.

BY BEEBY THOMPSON, F.G.S., F.C.S.

PART II.

Palæontology.

(Continued from page 224.)

Name.	Authority.	Margaritatus Zone.	Spinatus Zone.	Transition Bed.
Lamellibranchiata.				
Ostrea submargaritacea, *Brauns*		×	×	×
,, sportella, *Dumort.*		×	×	×
,, cymbium, *Lam.*, var. obliquata		×	×	
,, cymbium, *Lam.*, var. depressa		×	×	
Gryphæa gigantea, *Sow.*	Beesley	×		
,, Macculloch ii, *Sow.*, = Ostrea cymbium	Beesley	×		
Anomia numismalis, *Quenst.*				×
Pecten lunularis, *Röm.* / ,, liasinus, *Nyst.*		×	×	×
,, æquivalvis, *Sow.*		×	×	×
,, dentatus, *Sow.*, a var. of P. æquivalvis			×	
,, textorius, *Schl.*			×	×
,, calvus, *Goldf.*			×	
,, substriatus, *Röm.*				×
,, priscus			×	×
,, pumilus, *Lam.*	Walford			×
,, Humberti, *Dumort.*	Walford			×
,, articulatus	Beesley		×	
,, paradoxus, *G. S.*	Beesley		×	
,, demissus, *Phil.* (?)			×	
,, cingulatus, *Goldf.*	Geol. Survey		×	
,, acutiradiatus, *Godlf.*				×
,, acuticostatus, *Lam.*	Walford			×
,, angulatus	Geol. Survey		×	
Hinnites tumidus, *Ziet.*, = H. velatus, *Goldf.*			×	×
,, Davæi			×	
,, abjectus, *Phil.*	Judd		×	
Lima Hermanni, *Voltz*			×	×
,, punctata, *Sow.*			×	×
,, Eucharis, *d'Orb.*	Walford			×
,, gigantea, *Phil.*	Beesley	×	×	
,, pectinoides, *Sow.*	Walford			×
,, scabricula, *Tate*	Beesley		×	
,, Galathea, *d'Orb*	Walford			×
Limea acuticosta, *Münst.*		×	×	×
,, Juliana, *Dumort.*				×
Plicatula spinosa, *Sow.*		×	×	×
Harpax pectinoides, *Lam.*	Walford			×
,, Parkinsoni, *Brown*	Walford			×
Monotis cygnipes, *Y. & B.*		×		
,, calva, *Schl.*				×

Name.	Authority.	Margaritatus Zone.	Spinatus Zone.	Transition Bed.
Monotis inæquivalvis, *Sow.* ,, novemcostæ, *Brown*		×	×	×
,, Munsteri, *Brown*		×		
,, deleta, *Dumort.*		×		
,, papyria, *Quenst.* (?)			×	
,, echinata, *Chap. & Dew.*; nr. to	Walford		×	
Gervillia oblonga, *Moore* (?)	Walford			×
Inoceramus substriatus, *Münst.*		×		×
,, cinctus, *Münst.*	Walford			×
Pinna folium, *Y. & B.*	Beesley		×	
,, sp. (?)		×		
Modiola scalprum, *Sow.*		×		
,, numismalis, *Oppel.*		×	×	
,, subcancellata, *Buvig.*		×	×	×
Macrodon Buckmanni, *Rich.*		×		×
,, undatus, *Walford*				×
Cucullæa Münsteri, *Ziet.*				×
,, cancellata, *Phil.*	Walford			×
,, transversa, *Moore*		×		
Arca interrupta, *Moore*				×
,, elongata, *Quenst.*		×		
,, liasina, *Röm.*		×	×	
,, truncata, *Buckman*	Beesley	×		
Nucula variabilis, *Dumort.*		×	×	×
,, Palmæ	Beesley	×		
,, Hammeri, var. Cardiiformis, *Def.*				×
Leda Galathea, *d'Orb*				×
,, complanata, *Goldf.*	Beesley	×		
Trigonia Lingonensis, *Dumort.*	Walford		×	×
Astarte striato-sulcata, *Röm.* ,, amalthei, *Quenst.*		×	×	×
,, fontis, *Dumort.*	Walford			×
,, Voltzii, *Goldf.*	Walford			×
,, Camertonensis, *Moore.*				×
,, subcarinata, *Münst.*				×
,, subtetragona, *Münst.*				×
Cardita multicostata, *Phil.*		×	×	
Cardinia antiqua, *Phil.*		×		
,, lævis, *Y. & B.*		×		
,, crassissima, *Sow.*		×		
,, concinna, *Sow.* ,, Philea, *d'Orb.*			×	×
,, cuneata, *Stuch.*	Beesley	×		
Cypricardia cucullata, *Münst.* ,, pellucida, *Moore* (?)	Walford 	 ×	 ×	×
Hippopodium ponderosum, *Sow.*	Beesley	×		
,, ovale, *Moore.*		×		
Myoconcha decorata, *Münst.*	Walford			×
Tellina Lingonensis, *Dumort.*	Walford			×
,, gracilis, *Dumort.*				×
Protocardium truncatum, *Sow.*		×	×	
,, substriatulum, *d'Orb* (?)	Walford			×
Lucina pumila, *Münst.*	Beesley, Walford	×	×	(?) ×

Name.	Authority.	Margaritatus Zone.	Spinatus Zone.	Transition Bed.
Unicardium subglobosum, *Tate*		×	×	×
Tancredia Lingonensis, *Dumort.*	Walford			×
Lithodomus sp. (?)	Beesley		×	
Pholadomya ambigua, *Sow.*		×	×	
,, Simpsoni, *Tate*		×		
,, obtusalis, *Simp.*		×		
Goniomya heteropleura, *Agassiz*		×		
,, hybrida	Beesley	×		
Gresslya donaciformis, *Phil.*		×		
,, lunulata, *Tate*		×		
,, Seebachii, *Brauns*		×		
,, intermedia, *Simp.*		×	×	
Pleuromya liasina, *Schub.*		×		
,, costata, *Y. & B.*		×	×	
Ceromya petricosa, *Simp.*		×	×	×
,, bombax, *Quenst.*				×
Isocardia liassica, *Moore* (? Ceromya petricosa)			×	
,, Slatteri, *Walford*	Walford		×	×
Arcomya arcacea, *Seeb.*		×		
,, concinna, *Tate*		× (?)		×
,, hispida, *Simp.*		×		
,, vetusta, *Bean.*				×
BRACHIOPODA.				
Lingula Beanii, *Phil.*	Beesley	×	×	
Crania Griffini, *Dav.*	Beesley		×	
Thecidia (?)	Walford			×
Spiriferina Walcotti, *Sow.*	Beesley		×	
,, rostrata, *Schl.*			×	
,, oxygona, *E. Desl.*			×	
Terebratula punctata, *Sow.*			×	
,, punctata, var. Radstockiensis, *Dav.*			×	
,, subpunctata, *Dav.*			×	
,, Edwardsi, *Dav.*			×	
,, Walfordi, *Dav.*			×	×
,, Bakeriæ, *Dav.*	Davidson		×	
Waldheimia resupinata, *Sow.*			×	
,, indentata, *Sow.*			×	
,, cornuta, *Sow.*			×	
,, subnumismalis, *Dav.*			×	
,, florella, *d'Orb*	Walford		×	
,, Mariæ, (?) *d'Orb*	Walford		×	
,, Darwini, *Desl.*	Walford			×
Rhynchonella tetrahedra, *Sow.*			×	×
,, tetrahedra, var. Northamptonensis, *Walker*			×	×
,, tetrahedra, var. Dumbletonensis, *Dav.*	Walker		×	
,, subconcinna, *Sow.*			×	
,, variabilis, *Schl.*		×		×
,, acuta, *Sow.*			×	
,, rimosa, *Von Buch.*	Geol. Survey		×	
,, capitulata, *Tate*	Walford		×	

Name.	Authority.	Margaritatus Zone.	Spinatus Zone.	Transition Bed.
BRACHIOPODA.				
Rhynchonella fodinalis, *Tate*			×	
,, amalthei, *Quenst.*				×
,, Bouchardi. *Dav.*				×
CRUSTACEA.				
Crustacean claws (? sp.)			×	×
Entomostraca. two large sp. (*Mr. Stuttard*)	Walford		×	
Cythere Moorei, *Jones*	Walford			×
ANNELIDA.				
Serpula gordialis, *Goldf.*	Walford			×
,, tetragona, *Desl.*				×
,, triedra, *Quenst.*	Walford			×
,, capitata, *Phil.*				×
,, lumbricalis, *Schl.*	Walford			×
,, quinquecristata, *Münst.*				×
,, segmentata (?), *Dumort.*	Walford			×
Ditrypa circinata, *Tate*		×		×
,, etalensis, *Piette*				×
ECHINODERMATA.				
Cidaris amalthei, *Quenst.*			×	
,, spines (2 sp.)	Walford			×
Acrosalenia Banburiensis, *Wright*				×
Hemipedina (sp. ?)	Beesley		×	
Millerocrinus Hausmanni, *Röm.*				×
Pentacrinus gracilis, *Charles.* }		×	×	
,, Johnsonii, *Austin* }				
,, Jurensis, *Quenst.*		×		×
ACTINOZOA.				
Montlivaltia (sp. ?)	Beesley		×	
Thecocyathus tuberculata, *Tomes*				×
Thamnastrea Walfordi, *Tomes*	Walford		×	
,, Etheridgei, *Tomes*	Tomes		×	
Cyclolites cupuliformis, *Tomes*	Tomes		×	
POLYZOA.				
Diastopora liassica, *Goldf*			×	×
,, diluviana	Beesley		×	
RHIZOPODA.*				
Nodosaria	Slatter			×
Cristellaria varians, *Borne*	Walford			×
,, cassis, *M. F.*	Walford			×
PLANTÆ.				
Wood (coniferous drift wood)		×	×	
Fucoids		×		

(*To be continued.*)

* A good list of Foraminifera is given in Mr. Beesley's pamphlet, but as no distinction is made between "Capricornus" and "Margaritatus" Zone they could not well be quoted here.

CORRECTION.—At page 195 (July number), Dr. Callaway is made to say that because the rocks which rest upon the Wrekin volcanic axis and are partly derived from it are Cambrian, *therefore* the Wrekin series is *Upper* Cambrian. It should of course be *Præ*-Cambrian.

Natural History Notes.

BOTANICAL NOTES FROM SOUTH BEDS,

WITH VOUCHER SPECIMENS.

NAME.	DATE 1886.	DATE 1885.	ASPECT. 1886.	SOIL, SITUATION, &c. 1886.
Corylus avellana	Feb. 14	Feb. 1	N.	Hedge. Pistillate fl. only open.
Mercurialis perennis....	,, 14	Jan. 4	N.	Bank.
Daphne laureola	,, 28	—	W.	Under trees.
Helleborus viridis......	,, 28	Feb. 15	Open	Meadow. Inflorescence & foliage only.
Tussilago farfara	Mar. 7	Feb. 8	S.	Railway bank. Same station both years. In 1884 the date was Jan. 12th.
Ulmus montana........	,, 28	—	Open	Hedge-row.
Anemone pulsatilla	April 4	Apl. 12	—	Lower chalk escarpment.
Viola odorata..........	,, 4	—	—	Bank.
Potentilla fragariastrum	,, 4	Mar. 15	Open	Wood.
Anemone nemorosa	,, 4	,, 15	,,	,,
Caltha palustris........	,, 4	,, 27	,,	Meadow.
Ranunculus ficaria	,, 4	,, 8	,,	Wood. March 6th in 1884.
Salix capræa	,, 4	,, 8	,,	Wood.
Petasites vulgaris	,, 7	April 3	,,	Moist meadow. Many flowers in 1886, very few 1885.
Adoxa moschatellina ..	,, 11	Mar. 22	S.	Bank. Plentiful.
Prunus spinosa	,, 23	Apl. 12	W.	Hedge.
Nepeta glechoma	,, 23	,, 3	S. W.	Warm bank.
Ranunculus auricomus	,, 23	,, 28	W.	
Orchis mascula	May 16	May 5	Open	Moist meadow.
Geranium robertianum	,, 23	,, 28	,,	Coppice, a few yards over the county border in Herts.
Cratægus monogyna....	,, 23	,, 17	,,	Hedge.

The retardation of vegetation by the extreme cold of the winter months was most noticeable in the earlier spring flowers. *Tussilago farfara* has been observed in the same station for six or seven years, and was several weeks later than in any of those seasons.

JAMES SAUNDERS, Luton.

FLORA OF WARWICKSHIRE.—On the 14th of August I found, in a copse on the border of Packington Park, a large number of plants of Agrimonia which at once arrested attention by their unusual height. On measurement I found that they varied between 4ft. and 6ft., some of them even exceeding the latter height. At that time none of the fruits were ripe, but paying a visit to the same locality about a fortnight afterwards I found the ripe fruits to agree with the characters of *A. odorata*. This is the first record of this rare plant for North Warwickshire. In the same copse also *Genista tinctoria* was growing. —W. B. GROVE.

METEOROLOGICAL NOTES.—July, 1886.

The barometer was unsteady during the month, but its fluctuations were not large, the extreme range being less than an inch. The highest reading was 30·318 inches on the 3rd, the lowest, 29·346 inches on the 26th. Temperature was slightly above the average, resulting chiefly from the "hot wave" at the commencement of the month. On the 4th the sheltered thermometer rose to 87 degrees at Henley-in-Arden; on the same date the maximum at Loughborough was 85·1 degrees; at Hodsock, 82·8 degrees; and at Coston Rectory, 80·8 degrees. In the rays of the sun, 139·0 degrees was recorded at Loughborough, and 138·2 degrees at Hodsock, also on the 4th. From the 8th to the 17th temperature was much lower, the maximum at Loughborough on the 14th being only 61·9 degrees. From the 18th to the 21st there was another short "spell" of warm weather, the thermometer rising to 80·9 degrees on the 21st. The lowest readings were 39·0 degrees at Henley-in-Arden, on the 28th; 39·6 degrees at Coston Rectory, on the 18th; 41·3 degrees at Hodsock, on the 10th; and 45·3 degrees at Loughborough, on the 16th. On the grass, the thermometer registered 32·2 degrees at Hodsock on the 10th. Rainfall was rather above the average, the total values being 2·84 inches at Hodsock; 2·67 inches at Henley-in-Arden; 2·66 inches at Coston Rectory; and 2·44 inches at Loughborough. The number of days on which 0·01 of an inch, or more, fell, varied from 16 to 18. There was a remarkable absence of thunderstorms. Thunder was heard at Loughborough on the 2nd, 21st, and 25th, and at Coston Rectory on the 25th. The wind was generally moderate, and its prevalent direction from westward. A solar halo was seen at Loughborough on the 3rd.

Wm. Berridge, F.R. Met. Soc.

12, Victoria Street, Loughborough.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—Biological Section, August 10th. Mr. W. B. Grove, B.A., in the chair. The minutes of the last meeting were read and confirmed. Mr. J. Edmonds exhibited *Polyporus squamosus*, a fungus from an ash tree in the General Cemetery, measuring twenty inches across. Mr. W. B. Grove, B.A., exhibited *Equisetum maximum*, from the source of the Stour, near Halesowen; he also exhibited the following fungi:—*Lactarius piperatus*, *Boletus scaber*, *B. subtomentosus*, and *Russula vesca*, from the source of the Stour; *Panus torulosus*, *Cyathus striatus*, *Didymocladium ternatum*, from Packington; *Gomphidius gracilis*, from Rubery; *Stachylidium cyclosporum*, and *Polyporus blepharistoma* (new to county), from Lappal Tunnel.—Microscopical General Meeting, August 17th, Mr. W. B. Grove in the chair. Mr. H. Miller exhibited the samphire, *Crithmum maritimum*, gathered from rocks in Lee Bay, North Devon. Mr. W. B. Grove exhibited *Agrimonia odorata* from Packington (new to North Warwickshire); and the following fungi:—*Ag. phalloides*, *Ag. infundibuliformis*, *Ag. rugosus*, *Ag. lanuginosus*, *Lactarius fuliginosus*, *Russula rubra* (rare), *Boletus Satanas* (very poisonous), *B. variecolor* (new to the county), all from Packington; *Hygrophorus conicus*, from Marston Green; and

(for Mr. J. Hamson) *Paxillus atro-tomentosus*, from near Bedford.—GEOLOGICAL SECTION, August 24th. Mr. Edmonds exhibited a dahlia with two flower-heads, placed back to back, on one stalk. Mr. W. B. Grove exhibited *Ag. phalloides*, *Ag. columbetta* (new to county), *Ag. stanneus* (also new), *Ag. asterosporus*, *Gomphidius viscidus*, *L. cilicioides*, *L. cyathula* (new), from Ham's Hall and Coleshill; *Ag. Bongardii* (new to county), *Ag. confluens*, *Ag. infundibuliformis*, *Clavaria cristata*, and *Helminthosporium clavariarum* (new), from Edgbaston Park; *Diderma vernicosum*, from Marston Green; (for Mr. H. Hawkes) *Gomphidius viscidus* and *Cantharellus cibarius*, from Kingswood; and (for Mr. J. Hamson) *Ag. chrysophæus* and *Ag. humilis*, from Bedford.

BIRMINGHAM MICROSCOPISTS' AND NATURALISTS' UNION.—July 19th. Mr. J. Madison exhibited a type specimen of *Unio tumidus*, and three varieties of the same, *ovalis*, *ponderosa*, and *radiata;* Mr. A. T. Evans, pebbles from the Moseley Drift, with fossil fucoid forms, carboniferous sandstone, with fossils, &c.; Mr. H. Hawkes, the following fungi:—*Melampsora tremulæ*, *Protomyces macrosporus*, and *Puccinia ægopodii;* Mr. J. Harrison, jun., auditory ossicles of human ear. Under the microscope Mr. Tylar showed *Alcyonella fungosa;* Mr. Hawkes, female flower of *Anacharis alsinastrum*. An exhibition of microscopical slides was then made, Mr. H. Insley showing a series of botanical mounts in glycerine, which, as a mounting medium, he held to be superior to jelly or gelatine. The further exhibition and discussion was adjourned to August 9th.—July 26th. Mr. J. Madison showed specimens of *Helix rotundata*, var. *pyramidalis*, a caddis case wholly made of shells of *Planorbis alba*, and a small collection of foreign marine shells; Mr. Deakin, the white variety of *Erica tetralix*, from Sutton Park; Mr. J. Moore, British marine shells; Mr. A. T. Evans, pebbles from the Moseley Drift, containing Orthis, Modiola, head of trilobite, etc.; Mr. J. Harrison, jun., a stalactite from Matlock. A paper was then read by Mr. Corbet, on "A Visit to the Buckstone." The writer described the Buckstone as a large boulder in the Forest of Dean, composed of old red conglomerate, and estimated to weigh about eighty tons. It tapered to a point, and, resting on a slab formed a rocking stone, and probably owed its origin to denuding agencies. The writer described the damage it sustained at the hands of visitors who rocked it until it rolled down the hillside and was broken into several pieces, and though now restored to its former place and still worthy of a visit, it had lost much of its interest.

PETERBOROUGH NATURAL HISTORY, SCIENTIFIC, AND ARCHÆOLOGICAL SOCIETY.—July 15th. Botanical excursion. Conductor, Mr. J. W. Bodger. By Thorpe Meadows to Orton Stanch, thence by river side to Peterborough. Plants collected, *Sedum acre*, *Allium vineale*, and varieties, *bulbiferum* and *compactum*, *Spiræa Ulmaria*, *Thlaspi arvense*, *Lychnis Githago*, *Galium mollugo*, *G. palustre*, *Lythrum Salicaria*, *Stellaria glauca*, *Thalictrum flavum*, *Veronica anagallis*, *Geranium pratense*, *Cornus sanguinea*, *Achillea Ptarmica*, *Epilobium hirsutum*, *Butomus umbellatus*, etc.—July 22nd. Geological excursion, conducted by Mr. E. Wheeler, to Forest Marble Section, St. Botolph's Field.—July 29th. Botanical excursion, by lane from Thorpe to Milton. *Trifolium fragiferum*, *Ononis arvensis*, *Ballota fœtida*, *Stachys Betonica*, *S. sylvatica*, *Campanula Trachelium*, *Ligustrum vulgare*, *Bunium flexuosum*, *Bromus asper*, *B. erectus*, and *Festuca gigantea*, were among the plants collected.

A THREE-EYED REPTILE.

BY A. B. BADGER.

Australia and New Zealand have long been celebrated for the remarkable character of their fauna. They possess no representatives of the great families of mammals which inhabit other parts of the Old and New worlds, none of the Carnivora, of the Ungulata, of the Edentata, or of the Quadrumana; but in Australia, filling the places of these animals in the economy of Nature, we find numerous species of the Marsupials. In Australia, too, alone of all lands, lives that curious creature, half mammal, half reptile, the Ornithorhynchus, which lays an egg like a reptile, but has teats, and is covered with hair, like a mammal. New Zealand is much more deficient in animal life than Australia, but it possesses a reptile, *Hatteria punctata*, so peculiar that it has an order all to itself. In many respects it is very much like the lizards, in others it resembles the crocodiles; then, again, there are hooked processes on its ribs as there are on those of birds. The circumstance, however, with which we are now especially concerned is the presence of three fully developed eyes.

This wonderful fact was recently discovered by Mr. W. Baldwin Spencer, of Lincoln College, Oxford, and has been termed, by Professor Jeffrey Bell, the most remarkable discovery of the last twenty-five years.

Two of these eyes are the ordinary lateral organs of Vertebrates, while the third is median, and lies on the surface of the brain at the bottom of a small hole perforating the parietal bone of the skull. It is, however, surrounded by connective tissue and is covered externally by the skin, so that the question arises of what use it can be to the animal. At present no answer can be given, but what is far more important, the existence of this eye in Hatteria has shown the homology* of a structure which is present in all Vertebrates, but the significance of which was hitherto unknown. The structure referred to is a small papilliform outgrowth from the upper surface of the brain, called the *pineal gland*, a name utterly misleading, as it has no secretory function; it is also better known as the *epiphysis*. In most Vertebrates it is simply composed of connective tissue, but in Hatteria Mr. Spencer †

* Homology is the "relation between parts in different animals which results from their development from corresponding embryonic parts." (Darwin.)

† Mr. Spencer's attention was drawn to this subject through reading a paper by Graaf, a German observer, who had been working out the development of the epiphysis.

has found that it has all the structure of a perfect eye—that is, lens, choroid, and retina are present, the nervous elements of the latter being connected with the brain by nerve-fibres. All stages between this perfect state and the ordinary form of a mass of simple tissue have been discovered by Graaf and Mr. Spencer in various lizards and amphibia, and consequently the "pineal gland" is proved to be a median eye.

It is, however, important to note that this median eye differs essentially from the ordinary lateral eyes of Vertebrates in the arrangement of the layers of the retina. Now this structure is composed essentially of a layer of nerve-fibres, which unite at one point to form the optic nerve, and of a layer of minute bodies called *rods* and *cones*. The latter are connected with the nerve-fibres, and by them the energy of light waves is converted into a form capable of affecting nervous tissue. In the vertebrate type of eye the former of these two layers lies between the light and the rods and cones; but in the invertebrate type the position is reversed. This difference between the eyes of the two great classes of animals is due to their radically different modes of development, a subject of some difficulty, which need not be treated in a popular paper. Briefly, the nervous part of the vertebrate eye is developed as a hollow outgrowth from the brain, which is not the case in the Invertebrates.

The median eye of Hatteria has its layer of rods and cones placed between the light and the layer of nerve-fibres, and in this respect resembles the invertebrate type, but since it is formed as an outgrowth from the brain, we must regard it as really developed on the vertebrate type.

Now the presence in a Vertebrate of a third eye is sufficiently interesting, but beyond this it confirms certain theories respecting the ancestry of the Vertebrates, and it is here that the importance of the discovery lies. To appreciate it, however, we must consider a group of animals much lower in the scale of organisation.

There may often be found attached to the rocks and stones of our sea shores, when uncovered at low water, lumps of greyish, leathery substance, irregular in shape and size, which the casual observer would scarcely imagine to possess life, and certainly would not credit with being animals. If, however, one of them be roughly touched, a stream of salt water suddenly ejected into his face will disabuse his mind on these points, for this "Sea-squirt," or more scientifically, *Ascidian*, holds a high place in the animal kingdom, and belongs to that great division of it which is characterised by possessing a back-bone. This amazing fact has been ascertained by

following the life-history of certain species of Ascidia from the egg onwards, and the course of development is such as to leave no doubt but that these animals possess a median dorsal structure homologous with the "back-bone" of the Vertebrata. The Ascidia and Vertebrata ought, therefore, to be placed together in one class, the former being removed from their position near the Mollusca, with which animals they have no affinity. As, however, the back-bone of an adult fish or mammal is divided into a number of segments or *vertebræ*, whilst that of the Ascidia is not, the latter could not be classed as "Vertebrata," therefore all animals possessing a back-bone at all have been classed as "Chordata," from χορδή, a string of a lyre. The term "Vertebrata" is restricted to those animals which possess a segmented back-bone in adult life, though it is an important fact that in all of them when embryos it is gelatinous and unsegmented as it is in the Ascidians. Hence, in this condition, in both groups of animals, it is called the *notochord*, from νῶτον, the back. On the other hand, as the notochord is present in the tail only of the Ascidia, they have been termed "Urochorda," from οὐρά, the tail. It may be mentioned in passing that the curious degenerate Lancelet is also placed in a separate group of the Chordata.

The egg of the Ascidian is a simple cell, and after fertilisation becomes segmented; that is to say, it becomes divided first into two halves, then each of these becomes similarly divided, and so on, until at last when the process is complete we have a little mass or *morula* composed of a great many cells, from which the various organs of the Ascidian will be built up. After various changes our embryo becomes pear-shaped and hollow, having an aperture at the posterior end, the cavity being the primitive alimentary canal. Its dorsal surface now becomes flattened and grooved in a line parallel to the long axis of the embryo, the *medullary groove* being thus formed. The edges of the groove thicken and soon grow up over it, finally coalescing with each other along its whole length, thus forming a tube of cells—the *spinal cord*—enclosing the *medullary canal*. Meanwhile the notochord has been formed near the posterior end of the embryo, between the spinal cord and the primitive alimentary canal—that is, in exactly the same position as the back-bone in a man. It does not, however, extend into the trunk of the animal, but is confined to the tail which is now formed, and which continues for some time to elongate.

The development of the nervous system proceeds by the enlargement at its anterior end of the medullary canal

into a cephalic lobe, which may be described as the brain; hence we have a brain and spinal cord as in man. From the fore-part of the brain a single eye and a single auditory organ are developed.

Contemporaneously with these changes a mouth, œsophagus, stomach, and intestine have been formed, while on either side of the body, on a level with the brain, two branchial sacs or gills have been developed. As in a fish, water is taken into the mouth and driven out through the gills.

Below the mouth three papillæ grow out, and from the outer layer of the body a cuticular test is deposited.

The larva is at first confined within the egg-membrane, but soon escapes and swims about, now much resembling a tadpole. But unlike the tadpole, instead of developing into a higher form, it retrogrades, becomes fixed to a stone, loses its tail and the greater part of its nervous system, and when adult is the degraded form we started with—the Sea-squirt. In this stage, the gills open into an *atrial* chamber which has an aperture near the mouth, and it is through this that water is ejected when the animal is irritated. It is interesting to note that there is one Ascidian—*Appendicularia*—which does not retrograde in development but keeps the tadpole form throughout life.

It is on account of the presence of the following structures in both Ascidia and Vertebrata that they are classed together:—

1. There is a notochord which lies between the nervous system and the alimentary canal.
2. The nerve-cord is dorsal and not ventral as in worms, insects, molluscs, &c.
3. Gill-slits are present which perforate the walls of the pharynx.

From this and other evidence it has been conjectured that the ancestral forms of the back-boned animals had a notochord as their sole axial skeleton; a ventral mouth surrounded with suctorial structures; and very numerous gill-slits. It must not, however, be supposed that the Ascidians are direct ancestors of the Vertebrates; on the contrary, they are only degenerate off-shoots from the ancestral stock.

Now, although the Ascidian larva closely resembles the Vertebrates in the most important points, yet in several details it differs, and most obviously in possessing a single median eye instead of two lateral eyes. This eye is developed as an outgrowth from the brain, and in that respect resembles the vertebrate eye, but it is very much simpler in structure, and,

strange to say, is placed on the inner surface inside the brain. From this fact Professor Lankester argues that the ancestral form must have been a transparent animal and have had an eye or a pair of eyes inside the brain. To explain the presence of the two lateral eyes in the Vertebrates we could suppose either that the single eye of the Ascidian was shifted to one side, and a second developed on the other; or that the ancestral Chordate had two lateral eyes, one of which the Ascidian larva has lost; or that two lateral eyes have been developed independently of the median which has disappeared. The latter theory is doubtless correct, as the median eye of Hatteria is evidently homologous with the single eye of the Ascidian. Probably the arrangement of the retinal layers according to the invertebrate type is due to the direction of the eye in Hatteria being altered, as it looks away from the brain instead of into its cavity. But a study of its development in various animals will no doubt explain this difficulty.

The discovery, then, of this median eye in Hatteria confirms the theory that the Ascidians are closely connected with the Vertebrates, and adds another detail to the idea previously formed of the ancestor of the Chordata—that it had a single median eye.

In conclusion I would remind all readers of this paper that our knowledge of this and kindred subjects will be materially increased by the investigations of the Marine Biological Association, and would suggest that subscriptions to its funds will speedily result in definite acquisitions to that knowledge. From this and other sources we may hope to glean such information that ere long we shall be able clearly to trace that most interesting of pedigrees, the descent of Man.

ON THE DISCOVERY OF ROCKS OF CAMBRIAN AGE AT DOSTHILL, IN WARWICKSHIRE.

BY W. JEROME HARRISON, F.G.S.

The Geological Survey Map of the Warwickshire Coalfield was executed between 1851 and 1854. It shows Dosthill as a mass of greenstone—bounded on the west by a line of fault which is also the boundary of the coalfield—and on the east breaking through, tilting, and burning the coal seams of the district.

The real structure of the little Dosthill ridge is rather different. When I made my first visit, on May 29th, 1882,

I found at least two varieties of igneous rocks penetrating annelidean shales of Cambrian age. There is a line of fault on the east, as well as on the west, by which the Cambrian and igneous rocks are sharply divided from the coal measures.

Dosthill lies twelve miles north-east of Birmingham, and two miles south of Tamworth. It is close to the Midland Railway (Birmingham and Burton branch), lying on the west of the line nearly midway between the stations at Wilnecote and Kingsbury. The extent of the ridge is one mile from north to south, and a quarter of a mile from east to west. The River Tame meanders over a plain of Keuper Marls on the west side of Dosthill, and the little eminence rises almost precipitously from this plain to a height of perhaps 200 feet. On the east side the slope is more gentle, though still rapid. Attacking Dosthill from the west, we find at the foot of the highest and steepest part an exposure of a hard brown grit or quartzite; then comes the mass of the ridge, in which exposures are not good or frequent. Where the rock is exposed we can clearly distinguish (*a*) a dioritic rock of a dull greenish colour, remarkably tough and refractory; (*b*) narrow dykes—similar to those called "dun-dykes" by the Hartshill quarrymen—of a brownish colour, very rotten and decomposed; (*c*) pale-grey shales—precisely similar to certain beds in Merevale Park, &c., on the opposite side of the coalfield—traversed by innumerable worm-borings, which usually run either parallel to the bedding, or at right angles to it. I have found obscure traces of other fossils, but the time at my disposal has not hitherto allowed me to make any thorough search of the beds. All these rocks are very much jointed. The exact similarity of this group of strata, the associated igneous and aqueous rocks being precisely alike in their characters, to the strata between Atherstone and Nuneaton on the east side of the Warwickshire coalfield, which it was my pleasure to aid Professor Lapworth in proving, also in May, 1882, to be of Cambrian age, compels us to assign these Dosthill Shales also to the Upper Cambrian Period.

At the southern end of the Dosthill ridge there is a field-quarry in which an admirable section is shown of a "neck" of igneous rock, rising through the Cambrian shales and spreading out above and over them. The shales show small signs of alteration, and that only in immediate contact with the dyke, where their surfaces look burnt, and discoloured by an irony deposit. A stream-course in this field runs across the ridge and ought to yield a good section, but on the occasions of my visits it has been so overgrown with vegetation as to be impassable.

Another junction of Cambrian shales with trap-rock is found just south of the little cross road—a cul-de-sac—which leads to a house near the highest point of the ridge; and there is another outcrop in the next field west of this.

At the northern end of the Dosthill ridge the gardens of Dosthill Lodge occupy part of the site of an old quarry. The igneous rock here is of the grey decomposed kind, with a central harder vein. It can be traced northwards like a wall for some little distance, looking like a miniature Derbyshire "edge." A little further north still there is a roadside section of coal-measure shales and sandstones, in a line with, and east of Dosthill House.

At the eastern part of the Dosthill ridge the Midland Railway cutting shows a fine and continuous section of sandstones, ironstone, shale, &c., cf Carboniferous age, including the outcrop or "smut" of five coal seams.

All the Carboniferous rocks here have a very high easterly dip, amounting to seventy-five or eighty degrees, where they are seen close to the line of fault which separates them from the Cambrian strata. Thus the latter are sandwiched, as it were, between Coal-measures on the east and Keuper Marls on the west.

When the Dosthill mass was believed to be an intrusion of greenstone into coal-measures, it was reported that the coal was "burnt" at the junction. But old colliers and "viewers" whom I have questioned have described to me the coal seam as being broken and even reduced to powder, but they had none of them noticed any appearance of charring or coking. Doubtless all the effects observed can be explained by the breaking of the strata along the line of fault. The coal seams have here been followed vertically from their outcrop, and at the present time a line of collieries is in full work quite close to the fault, and within a few yards of Cambrian strata. In few places are they brought into such close proximity.

Flora of Warwickshire.—I should like to correct a statement which occurs on page 255 of the last number of "The Midland Naturalist," in which *Agrimonia odorata* is said to be "new to North Warwickshire." This I found at Austrey, near Tamworth, in August, 1885. This is one of very many plants that I have been able to add to the Flora of North Warwickshire during the past twelve months. As the "Flora" is being prepared for publication in the book form, I have not considered it needful to rush into print every time I have found a new plant, or a rare plant in a new station. I invite botanists to be obliging enough to send me notes of any new finds in Warwickshire, and I shall gladly acknowledge them in the proper place when a new edition of the "Flora" appears.—J. E. Bagnall, 84, Witton Road, Aston, near Birmingham.

THE BOLETI OF THE BIRMINGHAM DISTRICT.

BY W. B. GROVE, B.A.

The discovery this year of three species of Boletus, new to the Birmingham district, suggests a few notes concerning them, to draw attention to their abundance here, in species, if not in individuals. It is well known that several kinds of Boletus are good eating, but it is probable that one which I find to be abundant is usually passed over, because it has not ordinarily the reputation of being edible. For the sake of those not much acquainted with fungi, it may be premised that the genus Boletus is one which contains large fleshy species, with a central stem and a cap or pileus more or less like a common mushroom in shape, but having instead of gills a mass of contiguous vertical tubes, the lower ends of which consequently present a number of roundish openings, called pores.

Taking the "Handbook" as our guide—because none of the species since added to the British Flora have been discovered here—we find in the first place that every member of the section "Viscipelles" is recorded for this district. I found the first, *Boletus luteus*, in Sutton Park in 1881. Mr. J. E. Bagnall, A.L.S., records it for Middleton, and also *B. elegans* for Coleshill Heath and Great Packington. The common yellow ringed Boletus, in all places near Birmingham, is *B. flavus*, which was first described under this name by our own botanist, William Withering. It was previously figured by Bolton as *B. annularius*, and was mistaken by Sowerby for *B. luteus*. There is undoubtedly a very striking likeness between these species; one may often see large numbers of Boletuses growing together, some showing the bright yellow pileus, characteristic of *B. flavus*, and others a browner pileus, reminding one of *B. luteus*, but all evidently the same species in various stages of growth. The reticulation of the yellow apex of the stem of the former, above the ring, by the decurrent pores, is well known to be a specific character, and certainly when compared with the white glandular* apex of a typical *B. luteus* would seem to afford an easy means of distinction. But on examining a large number of specimens it will be found that this reticulation gradually disappears until the apex of the stem becomes merely scabrous, although remaining yellow. Still I have

* The glandular aspect is caused by little groups of the subferruginous spores clinging to the fibres which roughen the stem. These spores have no tinge of yellow, as those of *B. flavus* have.

not, for the last five years, seen in any wood round here specimens which could be safely referred to *B. luteus*. *B. flavus* I have found in Sutton Park, at Hampton, Coleshill Pool, Marston Green, Bradnock's Marsh, Earlswood, Lickey Hills, and Rubery; Withering found it in Edgbaston Park, and Purton in Ragley Woods and on Oversley Hill; Mr. Bagnall recorded it from Middleton at the same time as *B. luteus*. It seems, according to authors, to be much more common in England than on the Continent.

The next species, *B. laricinus*, is recorded by Mr. Bagnall from Middleton, and I have found one specimen at Oscott, which I think belonged to this species. I have seen *B. granulatus* not far from Barnt Green Station. Though reputed edible, it looks too slimy to be tempting. Withering found it in Edgbaston Park. Mr. Bagnall records *B. bovinus* from the neighbourhood of Coleshill, and I have found it at Trickley Coppice and Rubery.

A not uncommon species, according to my experience, is *B. badius*; it occurs in large quantities in Sutton Park, and at Bradnock's Hayes, Middleton, Coleshill Pool, Streetley, Hints, Edgbaston Park, and the Lickey Hills it can be found sometimes in considerable numbers. This is the species referred to as not being currently reputed edible, and it must be confessed that the disagreeable blue-green tint assumed by the pores (and to a less extent by the flesh) on touching them is not at all inviting. This discoloration, however, passes away in a short time. By itself, this fungus is not to be recommended, but its thick and substantial flesh makes it a welcome addition to that mixture of species in which the confirmed fungus-eater usually indulges. Cooked with a quantity of *Ag. rubescens*, such as can nearly always be gathered at the same time and place, it makes a delicious dish. The tubes and stem should be removed (the tubes separate remarkably easily), and the pileus cut into slices as one would cut a loaf of bread, and fried in the rich liquor yielded by the other species and a lump of butter; pepper and salt to taste.

The next species, *B. sanguineus*, owes its detection and its name to Dr. Withering. He found it in Edgbaston Park; Purton found it on Oversley Hill; and it has been discovered, though rarely, in various places on the Continent. Last July I came across a group of specimens in Packington Park exactly agreeing with Withering's description; both the "button state" and the "expanded state" grew together, and thus confirmed the accuracy of their identification, of which he expressed a slight doubt.

The last species of this section, *B. piperatus*, I found once near Berkswell; Mr. Bagnall records it for Middleton. Its pungent taste, which was very decided, rendered its identification easy.

In the next section, "Subtomentosi," every species but one is found here, the exception being the very rare *B. rubinus*. Mr. Bagnall had the good fortune to find the curious *B. parasiticus* in the Middleton district in 1884. He records *B. striæpes* from the same locality, and has kindly informed me that Mrs. Russell found it at Kenilworth. I came upon magnificent specimens of *B. variegatus* in the woods around Coleshill Pool, and of *B. variecolor* on the edge of Packington Park. The peculiar fasciculate scales on the pileus of the former, and the beautifully reticulated stem of the latter, distinguish them easily from their allies.

The two remaining species of this section are rather common; *B. chrysenteron* abounds in Sutton Park, and I have found it more sparingly about Four Oaks, Hints, Water Orton, and Bradnock's Marsh. *B. subtomentosus* is more frequent. I have seen specimens at Sutton Park, Coleshill Pool, Middleton, Berkswell, Packington Park, Bradnock's Marsh, Edgbaston Park, Halesowen, Rubery, and the Lickey Hills. Withering found it also at Edgbaston, and Purton in the Ragley and Oversley Woods. Mr. Bagnall records it from Crackley Wood, Kenilworth. These two species closely resemble each other, especially in the cracked pileus; they are most easily distinguished in the field by the fibrous and crimson-streaked stem of *B. chrysenteron*, and the smoother, but ribbed, yellower stem of *B. subtomentosus*; in the latter, moreover, the stem usually tapers at the base.

In the next section, "Calopodes," again one species is unrecorded for this district. Of the other two, *B. olivaceus* appears, so far as can be judged, to be the species intended by Withering under this name. He gives the locality as "Hedgebanks, Church Lane, Edgbaston," where, I fear, it would be useless to look for it now. What he calls "*B. olivaceus*, var. 2," from Packington Park, is probably *B. pachypus*, the third species of this section; this is also recorded by Mr. Bagnall from Middleton, etc., and by Mrs. Russell from Kenilworth. While not throwing any doubt on the occurrence of this species here, I feel bound to state that all the specimens which I have seen exhibited under this name were, in my opinion, merely irregular forms of *B. edulis*, with which their colours exactly agreed.

The next section, "Edules," contains four species, one of them not recorded for the district. *B. edulis*, the "edible Boletus," is not particularly common, though I have found it

in Sutton Park, New Park, Middleton, and Packington Park, and at Hints, Berkswell, Langley, and Coleshill Pool. Withering found it in Edgbaston Park, and at "Barr," Staffordshire; Purton on Oversley Hill; Mr. Bagnall at Baddesley Clinton; and Mr. Southall at Yardley Wood. This species certainly does not deserve the name "edible" more than *B. badius*, which I fancy is often mistaken for it. In fact, I was induced to venture upon eating the latter species by this belief, confirmed by the strong resemblance which the figures named *B. edulis* in Berkeley's "Outlines" (pl. 15, f. 6), and in the first edition of Cooke's "Plain and Easy Account of British Fungi" (pl. 15), bear to *B. badius*—a resemblance so striking as to induce one to believe that they may have been actually drawn from specimens of the latter species, especially as they do not particularly resemble that which they are said to be. The inference is that many a British mycophagist must have eaten *B. badius*, when he believed himself to be indulging safely in *B. edulis*.

To the next species of this section, *B. impolitus*, I have referred, but very doubtfully, a few specimens which I gathered near Bradnock's Marsh in the summer of 1884; these must wait for confirmation. The last of the four, *B. æstivalis*, I have found at Fen End. It is a most striking species, especially from its very thick stem.

The fifth section, "Luridi," also contains four species, all intensely poisonous; one, again, is not on record. The first, with a fine significant name, *B. Satanas*, I have found in Packington Park and at Fen End. The second, *B. luridus*, equally poisonous, is more common. I have seen it at Streetley, Langley, Berkswell, Hampton, in Packington Park, and near to Lappal Tunnel. Mr. Southall gathered it at Yardley Wood; Mr. Bagnall at Shustoke and Middleton; Mrs. Russell at Kenilworth; Withering found it in Edgbaston Park; and Purton at Oversley Hill and near Cold Camfort. The crimson pores and stem, and the olive or lurid-red pileus of this are in themselves sufficient to warn one against it, and its disagreeable aspect is increased by the fact that the bright yellow flesh, when broken, turns to a nauseous green sc swiftly that it really requires a little knowledge of gymnastics to be able to catch a glimpse before it changes.

To the third species, *B. erythropus*, I refer some specimens gathered in Sutton Park and at Coleshill Pool, in 1883, which resembled *B. luridus* but differed in their more slender stature and stem everywhere punctato-scabrous and not reticulated. They did not exactly agree with the description of that species, it is true, but I do not know where else to refer them,

and they cannot in any case be placed far from *B. luridus.* The fourth species, *B. purpureus*, has not occurred here; I saw some magnificent specimens at Hereford last year.

This concludes the Boleti which are said to have ochraceous spores. In the next section "Dermini," with subferruginous spores, there are three species, one of which is not known from this district. The second, *B. versipellis*, is probably that found at "Barr" by Withering, and in Oversley and Ragley Woods by Purton. They called it *B. aurantiacus*, and Purton's, at least, seem to be identical with what Sowerby figured in his pl. 110 which is now referred to *B. versipellis.* The third species is the common *B. scaber*, which is edible and indeed more pleasant to the taste than the other Boleti I have tried. One can easily distinguish it by its stem, which is strongly attenuated upwards and rough with numerous blackish fibres, the upper ends of which are free. It may here be remarked that the stems of Boleti seem to me oftentimes to offer more definite field characters than the other parts of the fungus.

In the next section "Hyporrhodii," the spores are of a rosy colour. These species are very rare; Fries records only two for the whole of Europe, both of which have been found in England. The first, *B. alutarius*, is not known here; I once thought I had found it, but was assured by a friend on whose judgment I can rely that this was a mistake. Last August, however, I found the other species, *B. felleus*, in Sutton Park, and exhibited a specimen at the opening Conversazione of the British Association Meeting. Dr. M. C. Cooke on seeing it informed me that he had not met with this species for the ten previous years, but that this year it had unexpectedly appeared in several distant places. He himself found specimens afterwards in another part of Sutton Park, on one of the excursions made thither during the Meeting of the Association.

In the last section, "Leucospori," there are only two species, both rare, neither of which has been found in this district. But the single species placed in the next genus, Strobilomyces, which is considered by Fries to be a true Boletus, was found in 1861, at the "Valley," Bromsgrove, by Mr. Wm. Mathews, M.A. This rare and wonderful fungus seems to have its favourite home farther to the west, in the district sacred to the Woolhope Club.

The foregoing certainly does not exhaust our list. I have found at least two other forms not identical with those previously mentioned, but which unfortunately I was not able to refer to any species described in the books at my command. The number of those included in this notice is twenty-six, of which one or two may be considered doubtful.

SCENES ON THE JOHNSTONE RIVER, NORTH QUEENSLAND.

BY CLEMENT L. WRAGGE, F.R.G.S., F. R. MET. SOC.

Having lately returned to Adelaide from my meteorological inspection tour, I can now send a few notes of my travels in Queensland, which I think will be of interest to my many friends at Home. Among other regions I visited the district of the Johnstone River in the vicinity of the sugar plantations—probably the most fertile piece of country in Australia. The Johnstone is navigable for vessels of light tonnage. The signal station for ships stands on a rocky capelet, open to the great Pacific, which forms a natural breakwater between the embouchure of the river and the swell of the ocean, thus forming a beautiful bay. Immediately to northward the neck of land widens, and becomes a luxuriant tropical garden. My visit was in November last. Here I wandered with much satisfaction, now strolling amid little groves of bananas, then wandering listlessly among fine clumps of cocoanut palms—shading in delicate tracery the wooden shanties of the station—and threading my way between long rows of tempting pineapple. Anon I pass shady bowers formed by the broad leaves of the granadilla, and then saunter into the dense native scrub at the back. The air is thick with butterflies, embellished with the most delicate colouring, and myriads more are settled on the bushes, sipping the nectareous juices of the flowers and fruits and the sacchariferous matter exuding from the foliage. My mind would swiftly travel to the other end of the world and draw contrasts between these lavish scenes and the cold fogs and drizzling rains enshrouding the leafless trees of my beloved Churnet Valley, while bleak Ben Nevis came in for his share in the thoughts. New beauties discover themselves at every turn. North and West are the noble hills, part of the Bellenden Ker range, covered with a great mantle of jungle stretching down, in tier upon tier of lustrous leaves, to the edge of the sea; while the contour of the coast-line is nicely broken by the broad flats backed by the green slopes at the mouth of the river. At length I rejoined the steamer and proceeded towards Geraldton. The temperature of the river at the mouth was 81·6°; dry bulb, 81·1°; wet bulb, 74·0°; at 11.15 a.m. I took a great number of observations throughout the trip, but only give a few selected values.

And now we are fairly in the Johnstone River. Can this be Australia? As we steam along, vivid recollections of other parts of this continent, visited by me during former voyages, crowd upon the brain. I picture myself wandering again over the stony deserts and dreary blue-bush plains of South Australia; anon I am tramping once more through the monotonous mallee scrub bordering the River Murray. Again my mind leads me to the endless vistas of cracked salt-pans and stunted mangroves of the plains of Carpentaria. I look up and make yet another contrast—for such contrasts form one of the keenest charms of travel. Behold! the luxuriance of the Johnstone fairly beggars description. The banks are clad with dense masses of tangled jungle—the very hot-bed of Nature. Flowering vines wrestle with lawyer-palms and wild bananas for the supremacy of existence. They mingle in one ravelling thicket of loveliness and health, now one kind predominating and then another. Beautiful evergreen trees shoot up boldly from the depths of the forest, decorated by gigantic festooning creepers of the convolvulus family, whose delicate white flowers against the various shades of green give a most pleasing effect. Then graceful cabbage palms proudly rear aloft the delicate outline of their quivering branches, forming an exquisite picture against the background of hills. Numberless tree-ferns push forth their huge and varied fronds from amid the thick undergrowth, and gracefully expand themselves to the light and life of the river. We soon reached Geraldton, the capital of the Johnstone district, and here the temperature of the river had risen to 83·9°. The place stands on the right bank. The architecture of the low shanties constituting the township, the old gnarled tree-stumps—all charred and black—where the adjacent land had been cleared, and the delicate green of the luxuriant bananas, unite the characteristics of scenes I have beheld around Colombo and Galle, and in the backwoods of Canada, with the bush aspect of a Queensland settlement. Verily such a picture is singularly fascinating. It is so essentially Colonial—so suggestive of the active wild life of the settler, and of a delightful freedom from the conventionalities of civilised life.

Forward again went the launch up this beautiful river of the tropics. On both sides the wealth of vegetation is marvellous, testifying to the powerful influence of a rainfall averaging 0·400 inch daily. In festooning wreaths, delicately wrought by the lavish hand of Nature, the graceful creepers hang over the water. There again is *Convolvulus multivalvis*, with its white flowers so chastely delicate peeping out from among the tangle of ferns and palms; and there is *Entada*

scandens, the famous "match-box bean," with its giant pods. Densely packed to right and left are still the beautiful cabbage-palms, *Archontophœnix Cunninghami*, formerly known as *Seaforthia elegans*. The trunks of these graceful trees, so characteristic of the Johnstone scenery, are used for making bridges over creeks, while the upper portion of the stem is eaten by the wild native. Lawyer-palms, *Calamus caryotoides*, continue equally abundant.

But anything I may have written already in attempted description of the scenery on the river's banks will convey but a very poor idea of the prodigality of vegetable life in the thick of the Johnstone scrub. In the course of my voyages I have seen many of Nature's beauties, but, to my mind, not even Ceylon equals the Johnstone in the lush of tropical flora. In the deep recesses of the jungle, besides the plants already mentioned, flourish magnificent specimens of the fan palm, towering up here and there, and mingling with the others in extravagant profusion. Even the birds'-nest fern, *Asplenium nidus*, must have a place, and attaches itself to any excrescence high up the trunks of various trees. *Kentia monostachya* and *Areca alicæ* are other examples of the palms. I also saw *Bowenia spectabilis* of the cycads, *Selaginella leptostachya* of the lycopods, and *Oplismenus compositus*, *Eleusine Indica* and *Centotheca lappacea* of the *Gramineæ*, and obtained specimens. I also came across a member of the *Solanaceæ*, strongly allied to the "Dead Sea apples," which I gathered some years ago near Jericho when travelling in Palestine. I have also seen a similar plant at Botany Bay.

Did space and time allow I could write a volume on my Queensland travels. I took extensive meteorological observations on the coast between Brisbane and the Albert River in the Gulf of Carpentaria, and have obtained samples of many of the mollusca inhabiting these seas; besides making geological and botanical collections, and taking voluminous notes during long journeys inland.

THE MONUMENTAL BRASSES OF WARWICKSHIRE.

BY E. W. BADGER, M.A.

(Continued from page 249.)

WARWICK, St. Mary's. I.—*Thos. de Beauchamp, Earl of Warwick*, 1401, *and Countess Margt. Haines.*

These magnificent effigies, which are 5ft. long, are now mural, and are placed above the entrance to the Beauchamp

Chapel. The Knight wears a bascinet, chain camail, and suit of plate armour with roundels at the elbow-joints and gussets of mail at the armpits and insteps. The skirt of his hawberk, ornamented with a fringe of small bunches of rings, is visible beneath the *jupon*. The edges of the bascinet are ornamented with the well-known "ragged staff," the epaulières, coutes, gauntlets, genouillières, and sollerets are profusely chased. The *jupon*, a short close-fitting cassock with escalloped skirt, is diapered with an elaborate design, and upon it are emblazoned the Beauchamp arms, Gu. a fess bet. six crosses crosslet or. Round the Knight's hips is a transverse belt supporting a sword and dagger, all highly decorated. At his feet is a chained bear.

At the Earl's right side is the Countess, whose hair, gathered in a caul at the top of her head, falls down on each side of her face to be again gathered in a smaller caul on each side. Upon her kirtle, with its long buttoned sleeves, are emblazoned the arms of Ferrers of Groby, to which family she belonged: and upon her mantle the Beauchamp arms. A small lap-dog sits at her feet.

Thomas Beauchamp, 4th Earl of Warwick, had a chequered career. He served Edward III., and was appointed one of the governors of Richard II. When that King assumed the government, Beauchamp retired to Warwick, built the N.E. tower of the castle, and enlarged S. Mary's Church. The Earl was subsequently charged with high treason and condemned to death, the sentence being changed for one of banishment to the Isle of Man. Upon the deposition of Richard by Henry IV., Warwick was recalled and reinstated. Haines gives references to illustrations of this brass in Dugdale, Gough, Vol. II., Pl. 2, and Waller, Pl. 6. The first-named gives a picture of the original tomb, which was destroyed by fire.

II.—*Thos. Oken*, 1573, *and w. Jone. Haines.*

These figures are 23in. high, and are now mural in the N. transept. The husband has close-cropped hair and a pointed beard. He wears a fur-lined civilian's gown with false sleeves, over a long belted doublet. Upon his feet are round-toed shoes.

The wife wears a small circular cap with lappets covering her ears, and a loose over-gown with falling collar and puffed sleeves. It is confined by a sash at the waist, but being open from that point downwards displays an under-dress, the neck of which is visible above the falling collar.

Round the lady's neck is a narrow ruff, or it may be the edging of the *partlet*, "a kind of habit-shirt of fine materials with ornamental edging."

The following is the inscription :—

giue
Of your charyte thanks for the Soules of Thomas Oken & Jone | hys wyff on whose Soules Jesus hath m'cy Jesus hath m'cy amen | Remember ye charyte for the pore for ever Ao dni mccccclxxiii.

The story of Thomas Oken's dream will be found pleasantly told in "Historic Warwickshire," by J. Tom Burgess. Thomas Oken's benevolence appears to have reached "all sorts and conditions of men" in Warwick, Banbury, and Stratford, to the Bailiff and Aldermen of which place he bequeathed money, part for the delivery of a sermon to them, "the rest they themselves to make merry with, and at the end of their mirth, give God Thanks and say the 'Lord's Prayer.'"

III.—*Inscription. Eliz. Chowne.* 1597.

A plate 20in. by 10in., on the floor of the chancel, not mentioned by Haines.

AN EPITAPHE VPON THE DEATH OF MRES ELIZABETH
CHOWNE WHO DIED THE LAST DAY OF AVGVST, 1597.
HERE LIES ELIZABETH, TWICE HAPPIE WIFE,
OF TWO GOOD VIRTVOVS MEN, BLEST FROM ABOVE ;
WITH BOTH, SO WITHOVT BOTH, A GODLY LIFE
TILL SEAVENTIE FIVE SHE LIVED, IN PERFECT LOVE.
RESTING A WIDDOW EYGHT, AND TWENTIE YEARES,
JOYEING TO SEE HIR DEAREST ISSVE WED,
BEFORE HIR GOD IN GLORY SHEE APPEARES,
HIR CORPS FEEDE WOORMES, HIR SOWLE BY CHRIST IS FED.
ANNO ÆTATIS SVÆ 75°.

IV.—*Inscription. Cisseley Puckering*, 1636. *Haines.*

This memorial, which is near the last, consists of three brass plates. Upon the first, 17½in. by 10½in., is the following inscription :—

MEMORIÆ SACRVM.
CECILIÆ PVCKERING FILLÆ NATV
SECVNDÆ THOMÆ PVCKERING
MILITIS ET BARONETTI QVÆ
X̄TO DESPONSATA OBIIT 9° DIE
APRILIS ANNO D̄NI 1636
ÆTATISQ. SVÆ 13°.

In English :—

Sacred to the memory of Cisseley Puckering second daughter of Thomas Puckering Knight and Baronet ; who being wedded to Christ died the 9th of April, A.D. 1636, in the 13th year of her age.

A second plate, about the same size as the last, bears this anagram (compare MERIDEN) :—

Miſtres Ciſſeley Puckering
I ſleep ſecure, Chriſt's my King.

Death's terrors nought affright mee, nor his ſting
I ſleep ſecure, for Chriſt's my ſovereigne King.

A third plate, 22in. by 13½in., bears this epitaph :—

Birth, breeding, beauty, grace and carriage ſweet
In thee Deare Saint did all togither meet.
The ſunne ne're ſaw a comelier face then thine
Nor Heaven received a ſpirit more Divine.
Thrice happy Parents ſuch a child to breed
Begott agayne of God's immortall ſeed.
Ceaſe ſorrow then ſith Saints and Angels ſing
To ſee her matcht with an eternall King.

V.—*Inscription. Thomas Rous of Rouslench.* 1645.

Upon a plate 14in. by 8in. :—

MEMORIÆ SACRVM THOME | ROVS FILII NATV QUARTI THOME | BARRONETTI ROVS DE ROVSLENCH IN COMI- | TATV WIGORNIE ^ QVI PRIMIS | ANNIS ÆTATIS SVÆ OBIIT | NONO DIE SEPTEMBRIS ANNO | DNI 1645.

In English :—

Sacred to the memory of Thomas Rous fourth son of Thomas Rous of Rouslench in the county of Worcester Bart., who died in his infancy. A.D. 1645.

WARWICK, S. Nicholas.—*Robt. Willardsey, first vicar*, 1424. *Haines.*

A very graceful figure, 17in. long, now in the vestry. It represents a tonsured priest vested for mass, in amice, chasuble, appareled albe, maniple, and stole (see COLESHILL). The amice, maniple, stole, and apparels of the albe are ornamented with cinquefoils. The folds of the chasuble are excellently represented.

The inscription is upon a plate, 18in. by 4in., and runs:

Hic iacet Robtus Willardsey prim' vicari' isti' | Ecclie qui obiit xvi° die mens' marcii anno dni | millo ccccxxiiii. cui' aie ppicietur deus ame.

Translation :

Here lieth Robert Willardsey first vicar of this church who died the 16th of March A.D. 1424. Whose soul God pardon. Amen.

This brass was stolen at the restoration of the church, but was fortunately recognised in a *bric-à-brac* shop in London by the late Rev. W. Staunton, and has been replaced in S. Nicholas' Church.

(To be continued.)

THE MIDDLE LIAS OF NORTHAMPTONSHIRE.

BY BEEBY THOMPSON, F.G.S., F.C.S.

PART II.

PALÆONTOLOGY.

(Continued from page 253.)

The list of fossils from the "*Margaritatus*" and "*Spinatus*" *Zones* and the "*Transition-bed*" of Northamptonshire includes 94 genera and 273 species. This is by no means a complete list, however, because I have a good number of fossils still awaiting identification, and Mr. E. A. Walford, F.G.S., I know, intends to publish a supplementary list from the Transition-bed at no very distant period.

A reference to the list will show that both *reptiles* and *fishes* are poorly represented in Northamptonshire, as indeed they are everywhere in these zones, in the British Isles.

Cephalopods are represented by 6 genera and 28 species at least, but so far as the Ammonites are concerned, the list is somewhat deceptive ; for, with the exception of the three belonging to the Amaltheus group, they are all Upper Lias forms, and are only met with at or near the junction with that formation, *i.e.*, in the Transition-bed or upper part of the Rock-bed. *Ammonites margaritatus* has a considerable vertical range in this district, as it has in many others, and hence is of very little use by itself as an indicator of the zone to which it has given a name. *Ammonites Valdani* seems a much more useful form on which to rely for drawing a palæontological boundary between the "*Margaritatus*" *Zone* and the beds below. This

latter ammonite is abundant in some of the lower beds, and passes upwards very near to, but just short of the "*Margaritatus*" *Zone*. *Ammonites margaritatus* is most common in bed "F," and is very variable in form; the varieties *A. gibbosus* (*Schl.*), *A spinosus* (*Quenst.*), and *A. subnodosus* (*Y. & B.*), and *A. depressus* (*Quenst.*) being all probably represented. *Ammonites spinatus* is decidedly rare in Northamptonshire, and appears to be met with only near the top of the Rock-bed. *Ammonites acutus* is very abundant in, and characteristic of the Transition-bed, but it is found occasionally just below or just above this zone. It is not uncommon to find forms having decided transitional characters leading to other members of the "falcifer" group, which are common in the Upper Lias. A flattening of the sides, brought about, not by a thinning of the shell, but by a filling out of the inner and outer edges of the whorls, with a consequently more abrupt fall into the umbilicus, and the development of a more distinct ribbing, seem to be changes which take place contemporaneously. It may be of interest to note here that the average specimens found at Tilton, in Leicestershire, are larger than the average ones found in Northamptonshire, and that the changes noted above may be more often observed in these larger ones.

I have already called attention to the abundance of *Gasteropods* in the Transition-bed, and the table of fossils well shows it; but the upper bed of the "*Margaritatus*" *Zone*—bed "F"—sometimes contains a large number of specimens, although the number of distinct species is small. Some recent work has revealed to me the fact that they are much more abundant in this bed than I had before suspected. The list of fossils does not show a very marked difference between the "*Margaritatus*" and "*Spinatus*" *Zones* as regards the distribution of the Lamellibranchiata, yet the former zone does contain a very much greater number of these than the latter. Speaking generally, *Pectens* are the only Lamellibranchs which are very common in the "*Spinatus*" *Zone*. Hinnites and Limas are practically not found below this zone, but they are not very common in it.

Pecten liasinus (*Nyst.*) occurs pretty evenly distributed in all the three zones, and the same remark applies to *Pecten æquivalvis*, though the variety *Pecten dentatus* (*Sow.*) seems particularly characteristic of the Rock-bed "B."

One thing which can scarcely fail to attract the attention of anyone studying beds of the "*Margaritatus*" and "*Spinatus*" *Zones* is the large number of *Cardinias* in certain restricted areas. *Cardinia antiqua* is fairly abundant in the lower beds in a good number of places, but more so at Milton

than elsewhere. *Cardinia lævis* in bed "F," and *Cardinia concinna* in bed "B," are abundant only at Watford, and *Cardinia crassissima* only at Daventry; indeed, I have not found this latter form elsewhere in the county.*

The *Myas*, which are exceedingly abundant in beds "F" and "H," are scarcely ever met with in the "*Spinatus*" *Zone*. *Pleuromya costata*, chiefly in "F," and *Pholadomya ambigua*, chiefly in "H," are the commonest forms.

Passing on to the *Brachiopods*, we notice that although rather numerous in species, and exceedingly so in numbers, there is only a record of two from the "*Margaritatus*" *Zone*. In Northamptonshire I have never myself found a single brachiopod in beds that I knew to belong to the "*Margaritatus*" *Zone*, hence the suggestion I made in a previous part of using the brachiopods as indicators of the "*Spinatus*" *Zone*. There is a section near to Daventry which illustrates this rather remarkable phenomenon. A single bed of stone 3ft. or 4ft. thick yields in the lower part *Gasteropods* and large numbers of *Cardinias*, *Pectens*, *Astarte*, *Cardita*, &c., characteristic of the "*Margaritatus*" *Zone*, but no brachiopods; the upper portion contains thousands of *Rhynchonella tetrahedra*, but not a single specimen of the fossils enumerated above, with the exception of the *Pectens*.

Serpulæ, it will have been noticed, are well represented in the Transition-bed. The *ossicles of Pentacrinites* are sufficiently abundant to constitute thick layers in the Rock-bed at various places.

Corals are decidedly rare; nearly all of those quoted in the list came from the extreme south-western part of the county. *Thecocyathus tuberculatus* has, however, a fairly wide range.

It is interesting to notice that a number of the fossils found in the Rock-bed and Transition-bed of Northamptonshire are met with much lower down in the Lias in other localities, and here, too, we should in all probability find them if we had better opportunities for examination, whereas they are absent in intermediate zones. I might give as illustrations, *Trochus Thetis*, *T. Gaudryanus*, *Pecten textorius*, *Spiriferina Walcottii*, *S. rostrata*, *Terebratula punctata*, *&c.* The migration and return of these may perhaps be used to throw more light on the physical conditions existing during the periods of their exile and return.

(To be continued.)

* The section in which this fossil occurs was only exposed recently, hence a description of it does not occur in Part I.

THE PRINCIPLES OF BIOLOGY.

BY HERBERT SPENCER.

Exposition of Part III., Chapter 3.

BY W. B. GROVE, B.A.

This chapter deals with the extension of the theory elaborated in the two previous chapters, to the Phanerogams, but it is so complicated and difficult to understand without diagrams that it will be advisable merely to state the conclusions arrived at, without attempting to show the reasons on which they are founded.

Mr. Spencer first shows that by observing the various forms of leaves of a Bramble stem, from the simplest to the most compound, we may have suggested to us the idea that the mid-rib of a leaf can assume the function of an axis; a phyllome becomes a caulome. The same thing is illustrated by Eucalyptus, Acacia, and Ruscus.

The chief problem to be solved is to show how the frond of an Acrogen can be transformed into a true caulome. After illustrating the change of leaf into stem by examples taken from the Euphorbiaceæ and Cactaceæ, it is pointed out that the first beginning of the process lies in that repeated proliferation of the frond of which examples may be found in the Jungermanniæ. By this means, a frond which was at first procumbent on the ground can take a step, literally, into a higher life. But before this process can be carried to any great extent, it will be necessary that the frond should be strengthened. This can take place in two ways, and, apparently, in two ways only:—(1) by an infolding of the margins of the frond, on the principle of a hollow iron column; this necessarily gives rise to the mode of growth called Endogenous; (2) by a thickening of the mid-rib; this produces that type of structure which is called Exogenous.

From this it follows that the unit of composition of a Flowering Plant is that portion of a stem which answers to the original frond; *i.e.*, an internode with its superjacent leaf. The proliferation of this gives rise to the internode above with its leaf. But occasionally a frond can give off a double proliferation. In this lies the origin of an axillary bud, when present. The axillary bud, therefore, is not essential to the leaf, contrary to the doctrine of those German theorists who would stifle all morphology within the iron folds of their artificial types.

A shoot of a flowering plant is thus an aggregate of the 3rd order, and the plants compounded of shoots in various degrees of complexity are aggregates of the 4th and higher orders.

If this theory is correct it must give an explanation of the remarkable coincidence of monocotyledonous seeds with endogenous growth, and of dicotyledonous seeds with exogenous growth. This it does with great facility; in the first case, where the strengthening of the frond is obtained by the infolding of the edges, it is shown that the second frond, which is necessarily enclosed within the first, must lag behind; in the second case, where the strengthening is achieved by the thickening of the mid-rib, the second frond can and may advantageously become equal to the first, and thus produce a dicotyledonous embryo.

MEETING OF THE BRITISH ASSOCIATION IN BIRMINGHAM.

BY A SECRETARY OF SECTION C.

The fifty-sixth Annual Meeting of the British Association commenced in Birmingham on Wednesday, September 1st. The Association was no stranger to the town, having met there previously in 1839, 1845, and 1865; in fact, Birmingham is the first town which has received a fourth visit from the the congress of scientists. The Meeting of 1865, under the presidency of Mr. John Phillips, was a remarkable one, but every effort had been put forth to surpass it on the present occasion, and the improved circumstances of the "Metropolis of the Midlands" enabled this to be done with complete success.

The proceedings commenced with the delivery of the annual address by the new President—Sir William Dawson, a distinguished Canadian geologist—in the Town Hall, on Wednesday evening. After glancing briefly at the advances in Science made during the twenty-one years which had elapsed since the Association met in Birmingham, he took for his main topic the history of the Atlantic, "That mighty ocean which unites, not separates, the people of two continents."

On Thursday morning the eight Sections into which the Association is divided began their work, sitting daily from eleven to three to listen to the addresses of their Presidents, and to hear the numerous papers—altogether about 400 in number—which had been contributed to the meeting. To give even an abstract of all these papers would require several numbers of this magazine, and we can only refer our readers to the daily papers published during the course of the Meeting, and to the annual volume which will contain the titles of all, and abstracts of most of them. In Section C (Geology) Prof. Lapworth and Mr. W. J. Harrison gave accounts of their recent discoveries in the geology of Warwickshire, and Mr. H. Johnson gave a valuable description of part of the South Staffordshire Coalfield. In Section F (Economic Science) Dr. Crosskey eloquently described the great work which is being done in the Birmingham Board Schools in the teaching of Science; in fact, each Section teemed with papers of local as well as of general interest, and we hope to print several of them in full in the "Midland Naturalist."

A new feature in the meeting was the institution of "Afternoon Walks" to places of scientific interest in the immediate neighbourhood, led by local scientists such as C. J. Woodward, J. W. Oliver, J. E. Bagnall, C. E. Beale, W. J. Harrison, and others.

Mr. G. B. Davis (Clerk) escorted large numbers over the Board Schools, and local manufacturers freely threw open their works to members of the British Association.

There were also half-a-dozen Garden Parties, to each of which from 200 to 300 guests were invited. These were given by various residents in the suburbs of Birmingham, and although the weather was somewhat uncertain, they proved very enjoyable.

Saturday afternoon (September 4th) and the whole of Thursday (the 9th) were devoted to excursions, which ranged over the Midlands, from Chatsworth on the east to Shrewsbury on the west, including Stratford, Warwick, Coventry, Enville, Lichfield, and including altogether seventeen places of interest. Everywhere the parties were cordially received, liberally entertained, and excellent arrangements were made that everything worth seeing should be seen under the most favourable auspices. The grand thunderstorm of Saturday evening met the returning tourists on that day, but the sight was so majestic and instructive that it more than compensated for the accompanying inconvenience.

The Exhibition of Local Industries in Bingley Hall proved a very great success, towards which Councillor Lawley Parker and Mr. G. H. Morley worked their hardest. The building is

magnificently illuminated by the (Gülcher) electric light, and the rows of busy workers engaged in diamond cutting, watch making, cigar making, &c., with the sound of music and machinery, make a brilliant and interesting sight. The building has been crowded daily since its opening. The soirée given on Thursday evening, September 2nd, enabled the members of the British Association to see the Exhibition at its best. Among its many points of interest we must not omit to mention the Natural History Section, the perfection of which was largely owing to the efforts of Mr. R. W. Chase and Professor Hillhouse.

A second soirée—given by the Mayor, Thomas Martineau, Esq., in the Council House and Art Gallery on Tuesday evening, September 7th—enabled the visitors to see David Cox's pictures illuminated by an ingenious form of electric light, devised by Messrs. Hookham and Chamberlain. The light is partially screened from the eyes of the observers, but falls directly upon the pictures.

Evening Lectures in the Town Hall were delivered by Professors Rücker, on "Soap Bubbles;" Rutherford, "The Sense of Hearing;" and Chandler-Roberts, "Colours of Metals and Alloys." The last-named was delivered to an appreciative audience of working men, and was a model of what a popular science lecture should be.

That union of scientific jokers, "Ye Red Lion Clubbe," held its annual dinner at the Liberal Club on Tuesday evening, September 7th, when there was much roaring and wagging of tails on the part of the "noble beasts" and their attendant "jackals." Burlesque addresses were delivered, and ——but we draw the veil, for dire is the vengeance vowed by the "king of beasts" against those who "tell tales" of his revelries.

When the members met to hear the result of the meeting in the Town Hall on Wednesday, September 8th, the smiling faces of the officials betokened general contentment. It was announced that 2,470 tickets had been disposed of, and that the Council had been able to allot grants amounting to £1,300 in aid of scientific research. Sir Henry Roscoe was elected president of the Manchester meeting, which takes place in 1887, and it was resolved to "go to Bath" in 1888. An invitation from the Australian Colonies to hold a supplementary meeting at Sydney in January, 1888, was also accepted.

The work of the meeting proper was fitly ended by a performance of the "Elijah," in the Town Hall, on Wednesday night.

Among the excursions on the final day (Thursday) was one "long excursion," in which Professor Lapworth led numerous "knights of the hammer" to the Longmynd and North Wales. This excursion was to extend over six days; we trust, however, that the "scenery" will not be seriously damaged.

Not to lengthen our report, we may say in conclusion that the officials of the Association—and their great experience makes them the best judges—pronounced the meeting a "great success." The fine group of public buildings in the very centre of the town—the Council House, Town Hall, Mason College, Midland Institute, &c.—enabled all the sections to be well housed, and in close proximity to one another. Our colonial guests—and they were many—appeared highly delighted, and every one joined in the wish that the British Association would come again to Birmingham, and that with the least possible interval.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY. — Biological Section, September 14th. Mr. W. R. Hughes, F.L.S., in the chair. The following were exhibited:—By Mr. C. Pumphrey, *Polygonum acuminatum*, in fine flower, and *Acanthus mollis*, a South European plant; Mr. Thomas Clarke, the seed vessel of a gourd, which is filled with Valparaiso cayenne pepper, as used on board a Chilian war vessel now lying in the Tyne; F. Clarke, a nest of the weaver bird; Mr. A. Browett, the fruit of what was thought to be the rare *Pyrus domestica*, from the garden of Mr. Jasper Moore, M.P., near Shrewsbury; Mr. W. R. Hughes, *Acorus calamus*, the sweet flag, in fruit, from Hewell Grange; Mr. T. Bolton, the jumping bean of Mexico, being the fruit of one of the Euphorbiaceæ, infested with the larva of *Carpocapsa saltitans*, from the Southern States of America; Mr. W. H. Wilkinson, the ripe fruit of *Pyrus Japonica*; Mr. W. B. Grove, B.A., *Ag. obscurus* (new to the district), *Ag. sublateritius*, *Ag. maculatus*, *Ag. testaceus*, and *Peziza cochleata*, from the Lickey Hills; and for Mrs. Taunton, a flower of *Stapelia*. An interesting discussion arose out of each of these exhibits, in which the Chairman, Messrs. W. B. Grove, C. Pumphrey, A. Browett, J. E. Bagnall, and others joined.—General Meeting, September 21st. Mr. W. B. Grove, B.A., in the chair. Mr. W. R. Hughes, F.L.S., exhibited *Atropa Belladonna*, deadly nightshade, also *Solanum Dulcamara*, woody nightshade, both in fruit, showing the contrast of the two plants. Mr. W. B. Grove exhibited the following fungi:—*Ag. hydrophilus*, from Sutton; *Lentinus lepideus*, from Staniforth Street, Birmingham; *Cylindrium flavo-virens*, from Edgbaston Park; (for Mr. Wm. Matthews, M.A.), two magnificent specimens of the "Parasol Mushroom," *Ag. procerus*, from West Malvern, one of them 12in. high; (for Mr. J. Hamson), *Hygrophorus calyptræformis*, from Bedford (a rare species); and (for Mr. H. Hawkes)

Rœstelia lacerata, on fruit of hawthorn. Mr. T. Bolton exhibited *Palmodictyon viride*, from Yardley Wood; also a caterpillar, sent by Mr. Edwin Smith, from Bantry Bay, said to be poisonous to cattle. Mr. W. H. Wilkinson exhibited a collection of plants from the Wren's Nest, Dudley, including *Carduus eriophorus*, the woolly thistle; *Viburnum opulus*, *Gentiana amarella*, *Polygala vulgaris*; also *Peltigera canina*, *Lecanora varia* (in fruit), and other lichens.

BIRMINGHAM MICROSCOPISTS' AND NATURALISTS' UNION. — August 9th. Mr. H. Hawkes exhibited the following fungi:—*Trichobasis fabæ*, *Xenodochus carbonarius*, *Sphærotheca castagnei* and *Erysiphe communis*; Mr. C. F. Beale, two roses, each with a bud growing from the centre of the flower; Mr. A. T. Evans, a pebble from the Moseley Drift, with fossil spirifer; Mr. J. Harrison, jun., specimens of quartz crystals, smoky quartz, chalcedony, jasper, etc. The exhibition of microscopical slides was continued, Mr. Hawkes showing a series of preparations of micro-fungi, notably one containing fourteen species on a slide, from simple *Uredo* spores to the complex Burnet brand; Mr. J. W. Neville, a series of preparations of whole insects without pressure; Mr. J. Moore, dissections of insects in balsam; Mr. Delicate, vegetable preparations in Deane's gelatine. A discussion on the advantages of certain media closed the meeting. August 16th.—Mr. H. Hawkes showed a collection of fungi from Symond's Yat, including *Uredo hypericorum* on *Hypericum perforatum*. Mr. W. Dunn then read a paper on "Low Life." The writer spoke of the development of low forms of life in infusions of oatmeal, fish, and tainted flesh, made with distilled water, spring water, and tap water; the latter gave the most speedy results. The infusion of oatmeal showed life in four days; that of fish the same. If the oatmeal was boiled a filamentous alga was the result, which grew to the end of six days and then gave place to animalcula. The manner in which water became sweet and clear after passing through stages of putridity was spoken of. A description of the life history of Amœbæ, Stylonychia, and Actinophrys brought the subject to a close.—August 23rd. Mr. C. P. Neville exhibited specimens of flying fish, and a small collection of marine shells, including specimens of *Pandora rostrata*; Mr. H. Hawkes, two fungi, *Peziza umbrorum* and *Cantharellus cibarius*; Mr. J. Collins, *Saponaria officinalis*; Mr. J. Madison, a two-banded variety of *Limnæa stagnalis*, several varieties of *Bulimus acutus*, including var. *nigriscens* from Portland, and var. *elongata* from Weymouth, and *Cyclostoma elegans* var. *fasciata* from Tintern and Portland; also a series of models of slugs, including seven varieties of *Arion ater*. Under the microscope Mr. J. W. Neville showed *Hispa atra*, a spiny beetle from Turkey; Mr. H. Hawkes, ova and young of *Balanus balanoides*, and cirrhi of adult; Mr. J. A. Grew, circulation in *Closterium lunula*.—August 30th. Mr. Hopkins showed larva of elephant hawk moth, *Chœrocampa elpenor*. Mr. Holden then read a paper on "The Pennine Chain, its Scenery and Geological Structure." The surface of England though generally level or undulating has two large mountain systems—the Cumberland group and the Pennine Chain. The latter is of considerable extent, reaching from the Cheviot Hills to the Peak of Derbyshire, or about 170 miles, the width being about forty miles, but varying considerably. Several of its summits reach an elevation of 2,000 feet or more. The chain forms the water parting of the northern drainage, and separates the dialects of Yorkshire and

Lancashire. The most characteristic rock of this formation is a quartzose conglomerate, and besides containing five important coal fields, it also produces iron, lead, zinc, copper, and salt. The writer described the birth, growth, and decay of the chain, its scenery, the erratic boulders found on its slopes, and some of the superstitions connected with their distribution. An exhibition of fossils and rock specimens illustrated the paper.—September 6th. Mr. C. F. Beale exhibited a specimen of *Chonetes lata* from the Upper Ludlow, and *Anthapalæmon grossartii* in Gubbin ironstone; Mr. Bradbury, a series of photographs of the Rocky Mountain scenery. Under the microscope, Mr. H. Insley showed Atlantic ooze from 1,180 fathoms, and Orbiculina from Bermuda.—September 13th. Mr. H. Hawkes showed *Chlora perfoliata* and other plants, from Ross, also a number of fungi, including *Cladosporium depressum* and *Rœstelia lacerata*; Mr. C. P. Neville, an abnormal growth of fuchsia, a leaf growing out of each side of the tube of the corolla; Mr. C. F. Beale, a leaf of fossil fern, *Pecopteris hirsuta*, from the coal measures, Illinois. Under the microscope, Mr. Hawkes showed a section of *Rœstelia lacerata*.

LEICESTER LITERARY AND PHILOSOPHICAL SOCIETY. —SECTION D, ZOOLOGY AND BOTANY. Chairman, F. T. Mott, F.R.G.S. Monthly Meeting, Wednesday, September 15th. Attendance, eight (two ladies). The following objects were exhibited, viz.: By Dr. Cooper, dried plants from North Wales, including *Spiræa salicifolia*, apparently wild. By Rev. T. A. Preston, a set of beautiful glass models, by Blaschka, of Dresden, of an obelia, showing the natural size of the polypidom, the same greatly magnified with the polyps in the cells, and the free medusæ in two stages; also models of several genera of sea anemones, and a few of Cole's microscopic slides. It was stated that the glass models could only now be got through Mr. Damon, of Plymouth, that the manufactory produces models of nearly a thousand species, but that the demand so much exceeds the supply that orders are rarely executed within twelve months, and small orders are scarcely attended to. By Mr. E. F. Cooper, dried plants for distribution from Saltby, in Leicestershire, including *Helianthemum vulgare*, *Asperula cynanchica*, and *Calamintha acinos*. By the Chairman, a metacarpal bone of *Bos longifrons*, the smallest of the old races of cattle, taken from the floor of the butcher's shop in the ancient Roman town of Uriconium, in Shropshire. The Chairman read a short paper on "Rats, and the occurrence of the Black Rat in Leicestershire"; exhibiting a specimen of the black rat recently captured at a farm about a mile from Leicester. The Chairman suggested that it would be useful and interesting work for the members of the section to practice the art of setting up life-groups of invertebrate animals, showing the history and habits of the species. These being small and easily preserved, groups could be set up pictorially without the apparatus of a special workshop, and such groups would be novel and extremely useful. He also stated that at the recent meeting of the British Association a committee was appointed to report on the Provincial Museums of the United Kingdom, and that he had undertaken the secretaryship of this committee, and he asked the members for information as to the existence of museums in various parts of the country, not established under the Public Libraries Act; of those under the Act he had a list already. The names of about a dozen such museums were at once suggested by the members present.

A YEAR WITH THE BIRDS.*

A very charming book bearing this title has recently been written by an Oxford Don, who is also a true lover of birds. It belongs to a class of books of which we have far too few—books in which interesting observations on natural history are preserved in a form to attract general attention. Our best book of the kind is White's "Selborne," and we do not think we are awarding too much praise to "A Year with the Birds" when we say it is a book of the same class. It is not necessary for its full enjoyment that the reader should be a scientific ornithologist. On the contrary, we should rather say it is a book written for the intelligent general reader, and more especially for those who, residing in the country, would gladly have their interest awakened in living things generally. It is strange that so few people care to know anything of the birds, insects, and flowers by which they are surrounded; this is probably due to defective education rather than to any other cause.

Chapters I. and II. are devoted to the birds the writer has met with at Oxford. "For several years past," he says, "I have contrived, even on the busiest or the rainiest Oxford mornings, to steal out for twenty minutes or half an hour soon after breakfast, and in the Broad Walk, the Botanic Garden, or the Parks, to let my senses exercise themselves on things outside me. . . . . In the peaceful study of birds I have found an occupation which exactly falls in with the habit I had formed—for it is in the early morning that birds are most active and least disturbed by human beings; an occupation, too, which can be carried on at all times of the day in Oxford with much greater success than I could possibly have imagined when I began it. Even for one who has not often time or strength to take long rambles in the country round us, it is astonishing how much of the beauty, the habits, and the songs of birds may be learnt within the city itself, or in its immediate precincts." The same may be said of many other spots in the Midland Counties, especially in all such where "the three chief requisites of the life of most birds" are to be found co-existent—"food, water, and some kind of cover."

As it is, perhaps, too much to expect that many adults who have reached or passed the meridian of life will be induced

* "A Year with the Birds." By an Oxford Tutor. Oxford: B. H. Blackwell; London: Simpkin, Marshall, and Co.

to follow our author's example, our chief hope of recruits must be in the children and young people. And here we cordially agree with the Oxford Tutor when he says, "I hold it to be an unquestioned fact that the direction of children's attention to natural objects is one of the most valuable processes in education. When these children, or at least the boys among them, go away to their respective public schools, they will find themselves in the grip of a system of compulsory game-playing which will effectually prevent any attempt at patient observation. There is, doubtless, something to be said for this system, though in my opinion there is much more to be said against it; but the fact is beyond question that it is doing a great deal to undermine and destroy some of the Englishman's most valuable habits and characteristics, and among others his acuteness of observation, in which, in his natural state, he excels all other nationalities. It is all the more necessary that we should teach our children, *before* they leave home, some of the simplest and most obvious lessons of natural history."

The book then proceeds to deal with Oxford birds in such a way that any reader, young or old, is enabled to recognise some of the most interesting species to be met with in the precincts of the city, and of course in other places too. The year is divided broadly into two seasons, winter—including the whole period from October to March; and summer—including all the warm season, from the commencement of Term time in April up to the heart of the Long Vacation. The familiar English names of the birds are invariably used, though for accuracy's sake a list of their scientific names is given in an appendix.

As specimens of the author's style and treatment of the subject we give the following extracts:—

"When we return to Oxford after our Long Vacation the only summer migrants that have not departed southwards are a few Swallows, to be seen along the banks of the river, and two or three lazy Martins that may cling for two or three weeks longer to their favourite nooks about the buildings of Merton or Magdalen. Last year (1884) none of these stayed to see November, so far as I could ascertain: but they were arrested on the south coast by a spell of real warm weather, where the genial sun was deluding the Robins and Sparrows into fancying the winter already past. In some years they may be seen on sunny days, even up to the end of the first week of November, hawking for flies about the meadow-front of Merton—probably the warmest spot in Oxford. White, of Selborne, saw one as late as the 20th of November, on a very sunny warm morning, in one of the quadrangles of Christchurch.

"It is at first rather sad to find silence reigning in the thickets and reed-beds that were alive with songsters during the Summer Term. The familiar pollards and thorn bushes, where the Willow Warblers

and Whitethroats were every morning to be seen or heard, are like so many desolate college rooms in the heart of the Long Vacation. Deserted nests, black and mouldy, come to light as the leaves drop from the trees—nurseries whose children have gone forth to try their fortunes in distant countries. But we soon discover that things are not so bad as they seem. The silence is not quite unbroken; winter visitors arrive, and the novelty of their voices is cheering, even if they do not break into song; some kinds are here in greater numbers than in the hot weather, and others show themselves more boldly, emerging from leafy recesses in search of food and sunshine." * * *

"I mentioned Parsons' Pleasure just now; and we may take it very well as a starting-point, offering, as it does, in a space of less than a hundred yards square, every kind of supply that a bird can possibly want; water, sedge, reeds, meadows, gravel, railings, hedges, and trees and bushes of many kinds, forming abundant cover. In this cover, as you walk along the footpath towards the weir, you will very likely see a pair of Bullfinches. They were here the greater part of last winter, and are occasionally seen even in college and private gardens; but very rarely in the breeding season or the summer, when they are away in the densest woods, where their beautiful nest and eggs are not too often found. Should they be at their usual work of devouring buds, it is well worth while to stop and watch the process; at Parsons' Pleasure they can do no serious harm, and the Bullfinch's bill is not an instrument to be lightly passed over. It places him apart from all other common English birds, and brings him into the same sub-family as the Crossbill and the Pine-Grosbeak. It is short, wide, round, and parrot-like in having the upper mandible curved downwards over the lower one, and altogether admirably suited for snipping off and retaining those fat young juicy buds from which, as some believe, the Bullfinch has come by his name.*

"Parsons' Pleasure, *i.e.*, the well-concealed bathing place which goes by this name, stands at the narrow apex of a large island, which is formed by the River Cherwell—itself here running in two channels, which enclose the walk known as Mesopotamia—and the slow and often shallow stream by which Holywell Mill is worked. The bird-lover will never cross the rustic bridge which brings him into the island over this latter stream without casting a rapid glance to right and left. Here in the summer we used to listen to the Nightingale, or watch the Redstarts and Flycatchers in the willows, or feast our eyes with the splendid deep and glossy black-blue of the Swallow's back as he darted up and down beneath the bridge, in doubtful weather. And here, of a winter morning, you may see a pair of Moorfowl paddling out of the large patch of rushes that lies opposite the bathing-place on the side of the Parks; here they breed in the summer, with only the little Reed-warblers as companions. And here there is always in winter at least a chance of seeing a Kingfisher. Why these beautiful birds are comparatively seldom to be seen in or about Oxford from March to July is a question not very easy to answer. The keeper of the bathing-place tells me that they go up to breed in ditches which run down to the Cherwell from the direction of Marston and Elsfield; and this is perhaps borne out by the discovery of a nest by a friend of mine, then incumbent of Woodeaton, in a deserted quarry between that village and Elsfield, fully a mile from the river. One would

* The name is said to be a corruption of *bud-finch*. But Professor Skeat (Etym. Dict., s. v. *Bull*) compares it with *bull-dog*, the prefix in each case suggesting the stout build of the animal.

suppose, however, that the birds would be about the river, if only to supply their voracious young with food, unless we are to conclude that they feed them principally with slugs and such small fry. Here is a point which needs investigation." * * * *

"The island which I have mentioned is joined to Mesopotamia by another bridge just below the weir; and here is a second post of observation, with one feature that is absent at the upper bridge. There all is silent, unless a breeze is stirring the trees; here the water prattles gently as it slides down the green slope of the weir into the deep pool below. This motion of the water makes the weir and this part of the Cherwell a favourite spot of a very beautiful little bird which haunts it throughout the October Term. All the spring and early summer the Grey Wagtail was among the noisy becks and burns of the north, bringing up his young under some spray-splashed stone, or the moist arch of a bridge. In July he comes southwards, and from that time till December or January is constantly to be seen along Cherwell and Isis. He is content with sluggish water, if he can find none that is rapid; but the sound of the falling water is as surely grateful to his ear as the tiny crustaceans he finds in it are to his palate. For some time last autumn I saw him nearly every day, either on the stonework of the weir or walking into its gentle water-slope, or running lightly over the islands of dead leaves in other parts of the Cherwell; sometimes one pair would be playing among the barges on the Isis, and another at Clasper's boat-house seemed quite unconcerned at the crowd of men and boats. * * * *

"The Grey Wagtail is misnamed both in English and Latin; as we might infer from the fact that in the one case it is named from the colour of its back and in the other from that of its belly. It should be surely called the Long-tailed Wagtail, for its tail is nearly an inch longer that that of any other species; or the Brook-Wagtail, because it so rarely leaves the bed of the stream it haunts. All other Wagtails may be seen in meadows, ploughed fields, and uplands; but though I have repeatedly seen this one within the last year in England, Wales, Ireland, and Switzerland, I never but once saw it away from the water, and then it was for the moment upon a high road in Dorsetshire, and within a few yards of a brook and pool. Those who wish to identify it must remember its long tail and its love of water, and must also look out for the beautiful sulphur yellow of its under parts; in the spring both male and female have a black chin and throat, like our common Pied Wagtail."

Chapter III. of "A Year with the Birds" carries the reader away to the Alps, and a delightful jaunt it is; the only fault we can find with it is that it is much too short. The next two chapters relate to birds as seen in a Midland village, and Chapter VI. to "The Birds of Virgil.' In departing from our usual custom by presenting long extracts from this book, our object has been to excite our readers to buy a copy for their own bookshelves, and when they have done so we feel quite sure of their gratitude. The book is beautifully printed, and bound with much taste. It is dedicated "Patri meo qui cum aucupis nomine avium amorem filio tradidit." Our readers will readily infer the author's name.

THE PRINCIPLES OF BIOLOGY.

BY HERBERT SPENCER.

Exposition of Part IV., Chapters V. and VI.

"The Morphological Composition of Animals." [Abstract.]

BY W. R. HUGHES, F.L.S.

In the opening sentence of the first of these two remarkable chapters Mr. Herbert Spencer directs attention to a previous section of the work (§ 180), and points out that "what was said respecting the ultimate structure of organisms holds more manifestly of animals than of plants." It will, therefore, be useful to quote this section almost in its entirety.

He says, in discussing the "morphological unit":— "Supposing that clay were the only material available for building, the proposition that all houses are built of bricks, would bear about the same relation to the truth, as does the proposition that all organisms are composed of cells. This generalization respecting houses would be open to two criticisms: First, that certain houses of a primitive kind are formed, not out of bricks, but out of unmoulded clay; and second, that though other houses consist mainly of bricks, yet their chimney-pots, drain-pipes, and ridge-tiles do not result from combination or metamorphosis of bricks, but are made directly out of the original clay. And of like natures are the criticisms which must be passed on the generalization, that cells are the morphological units of organisms. To continue the simile, the truth turns out to be, that the primitive clay or protoplasm out of which organisms are built, may be moulded either directly, or with various degrees of indirectness, into organic structures. The physiological units, which we are obliged to assume as the components of this protoplasm, must, as we have seen, be the possessors of those complex polarities which result in the structural arrangements of the organism. The assumption of such structural arrangements may go on, and, in many cases, does go on, by the shortest route; without the passage through what we call metamorphoses. But where such structural arrangements

are reached by a circuitous route, the first stage is the formation of these small aggregates, which, under the name of cells, are currently regarded as morphological units."

Mr. Herbert Spencer then takes a comprehensive morphological survey of all the classes of the animal kingdom from the *Protozoa* up to the *Vertebrata*.

In the *Rhizopoda*, the lowest division of the *Protozoa*, "are presented, under various modifications, these minute portions of living organic matter so little differentiated, if not positively undifferentiated, that animal individuality can scarcely be claimed for them." The well-known *Amœba* is a type of this living matter or protoplasm in its simplest form. It is the "clay" from whence the "bricks" are to be evolved. Several examples follow, showing slight modifications. In *Difflugia* the pseudopodia are limited to one part only. In the *Foraminifera*, of which *Gromia* is an illustration, the sarcode is covered by a delicate calcareous shell, through the minute holes of which the pseudopodia protrude. The *Infusoria* are more highly developed, and "in them we find along with greater definiteness a considerable heterogeneity." The aggregate is an aggregate of the first order, but in these and in similar organisms "the compound individuality is scarcely enough marked to subordinate the primitive individualities."

In a higher division, the *Cœlenterata*, the typical form of which is the *Hydra*, "having specialized parts performing mutually-subservient functions; and thus exhibiting a total life distinct from the lives of the units." The *Hydra*, therefore, illustrates the aggregate of the second order and the "massing of secondary aggregates into tertiary aggregates is variously carried on among the *Hydrozoa*, the *Actinozoa*, and the *Molluscoida*." Mr. Herbert Spencer, however, directs attention to the fact that in these divisions "the component individualities are very little subordinated to the individuality of the mass they form—there is only physical unity and not physiological unity." The united animals in nearly all the cases illustrated may fitly be compared to societies, the members of which co-operate to gain certain ends. It is pointed out that in some of the oceanic *Hydrozoa*—the Rhizostomes for instance—the integration is carried so far, "that the individualities of the polypes are almost lost in that of the aggregate they form."

Before considering the next higher division—the *Annulosa*—several beautiful illustrations are given wherein "successive individuals arising by continuous development are so budded-off as to form a linear series," and it is remarked that "survival of the fittest must tend continually

to establish types in which the connected individuals are more unlike one another, at the same time that their several individualities are most distinguished by the integration consequent on their mutual dependence." In the *Annulosa* and especially in the *Annuloida*, from "traits of structure development and mode of multiplication," it is shown that "every segment is in great measure a physiological whole—every segment contains most of the organs essential to individual life and multiplication; such essential organs as it does not contain being those which its position as one in the midst of a chain prevents it from having or needing." The *Annulosa* are therefore aggregates of the third order.

In approaching the consideration of a still higher division —the *Mollusca*—Mr. Herbert Spencer reverts to a previous section, and emphasizes the truth that "As before explained under the head of Classification, organisms do not admit of uni-serial arrangement either in general or in detail; but everywhere form groups within groups. Hence having traced the phases of morphological composition up to the highest forms in any sub-kingdom, we find ourselves at the extremity of a great branch, from which there is no access to another great branch, except by going back to some place of bifurcation low down in the tree." The *Mollusca* differ materially from their allies the *Molluscoida*—both considered as groups—in that they are single and not compound. "No true Mollusk multiplies by gemmation, either continuous or discontinuous; but the product of every fertilized germ is a single individual." The significant fact is then dwelt upon that homogenesis holds throughout an entire sub-kingdom, and that "there is no case in which the organism is divisible into two, three, or more like parts. There is no clustering as in the *Cœlenterata* or segmentation as in the *Annulosa*, the simulation of segmentation by one of the group of the *Mollusca*—the *Chiton*—being limited to the shell only, and to this segmentation being adaptive instead of genetic. The conclusion arrived at is therefore that a Mollusk is an aggregate of the second order. "Not only in the adult animals is there no sign of a multiplicity of like parts that have become obscured by integration; but there is no sign of such multiplicity in the embryo."

In the highest sub-kingdom—the *Vertebrata*—as among the *Mollusca*, homogenesis is universal. The two highest sub-kingdoms "are like one another and unlike the remaining sub-kingdoms in this, that in all the types they severally include a single fertilized ovum produces only a single individual." Occasional spontaneous fission of the vitelline

mass in the eggs of certain Gasteropods which may or may not form two individuals, and a probably similar fission imperfectly carried out among the Vertebrates, are regarded as abnormalities. "The vertebrate animal, under its simplest as under its most complex form, is like the molluscous animal in this, that you cannot cut it into transverse slices, each of which contains a digestive organ, a respiratory organ, a reproductive organ, &c. The organs of the least-developed fish as well as those of the most developed mammal form but a single physiological whole; and they show not the remotest trace of having ever been divisible "into two or more physiological wholes." Embryology and comparative morphology of the Vertebrata respectively furnish evidence to show that "that segmentation which the vertebrate animal usually exhibits throughout part of its organisation is the same in origin and meaning as the segmentation of a Chiton's shell; and no more implies in the vertebrate animal a composite structure, than do the successive pairs of branchiæ of the *Doto*, or the transverse rows of branchiæ in the *Eolis*, imply composite structure in the molluscous animal." Mr. Herbert Spencer's inference is, therefore, "that the vertebrate animal is an aggregate of the second order, in which a relatively superficial segmentation has been produced by mechanical intercourse with the environment." He finally says:—"We shall hereafter see that this conception leads us to a consistent interpretation of the facts, shows us why there has arisen such unity in variety as exists in every vertebral column, and why this unity in variety is displayed under countless modifications in different skeletons."

THE MIDDLE LIAS OF NORTHAMPTONSHIRE.

BY BEEBY THOMPSON, F.G.S., F.C.S.

PART III.

The Middle Lias Economically Considered.

(Continued from page 277.)

Building Stone.—Northamptonshire is usually regarded as a county possessing very little good building stone, for nearly all the new buildings in both towns and villages are built of brick. An excellent freestone is, however, obtained

from the Lincolnshire limestone (inferior oolite) in the north-eastern parts of the county, and in the middle portion of the county some good work has been done with the more calcareous beds of the Northampton sand, which is also a member of the inferior oolite. In the west and south-western parts of the county the building material of the past was undoubtedly the Rock-bed of the Middle Lias. If we draw on a map of the county a line in a general north-easterly direction connecting ROTHERSTHORPE, BUGBROOK, WEEDON, DODFORD, and DAVENTRY; and another nearly at right angles to this through BADBY, BYFIELD, CHIPPING WARDEN, BANBURY, and then to KING'S SUTTON, it will indicate the general direction along which the Middle Lias occupies a superficial position, and consequently the neighbourhoods in which to look for it, and in which we shall find abundant evidence of the uses to which the Marlstone Rock-bed has been put. Many of the villages have been built almost entirely of it, including the churches, and from the general appearance of such villages, we can scarcely regard the use of bricks as a necessity, except perhaps from a pecuniary point of view. In these places the stone is also used for doorsteps, the floors of houses, gravestones, fences, and road-metal; indeed, the (now only occasional) roadside heaps, and old walls often afford good opportunities for studying the palæontology of the bed.

The Rock-bed is the only hard bed of the Middle Lias used for building purposes, but this, when carefully selected, and built up as it occurs in the bed, forms a very useful and durable stone, and certainly looks much nicer than the more modern red brick.

In most quarries the stone is met with in two different conditions, the upper weathered portion of a rich brown colour, and lower down a more compact grey or greenish-blue stone; the former is no doubt much the better for general use, although I have seen both kinds used. Several reasons may be urged for preference being given to the more weathered stone. (1.) The weathered stone is much more easily worked than the harder unweathered. (2.) The stone should always be so placed in a building that the planes of lamination are horizontal, for the action of frost on a porous stone, such as the marlstone always is, would cause it to flake off if it were placed so that these planes were in anything approaching a vertical position, the pressure from above considerably aiding this action when so placed, whereas this same pressure would help to counteract it, and at all events tend to mask its effects when the stones were placed so that

the lamination was horizontal. Now when the hard compact stone has been quarried it is seldom possible to tell in what direction shaling will take place under ordinary weathering influences; hence it is exceedingly probable that much of the stone would be dressed and placed in a very unfavourable position for its lasting qualities. The weathered portions have already developed those characteristics by which its proper position in a building may be decided. (3.) The hard stone has retained its bluish-green colour owing to the fact that it has not been subjected to the action of percolating water and the gases contained therein; hence, if it were used in a building, the ordinary atmospheric influences would produce chemical changes in it such as have already occurred in the more porous or more superficial parts of the same bed, and these could scarcely be otherwise than detrimental, because they would be taking place first and most rapidly in the exposed parts. With building stones generally it is desirable that all chemical changes likely to take place through the presence of iron or other bodies should be completed before their use—that is to say, for building purposes the seasoned stone is preferable to the green.

Owing to the porosity of these weathered portions of the stone, which are chiefly used for building, a thicker wall is required than when bricks are used.

I may remark that buildings constructed of marlstone can scarcely be distinguished at a little distance away from those built of the more ferruginous portions of the Northampton sand.

Bricks are sometimes made from the clays of the "*Spinatus*" *Zone*, as at Market Harborough; and I believe some of the lower beds of the "*Margaritatus*" *Zone* are so used at and near Banbury, though I have never seen bricks made from them in Northamptonshire.

Road-Metal.—In those positions where the Rock-bed has been quarried most—that is, really where it is nearest the surface of the ground, the upper portion is generally rubbly in character, very much broken up, and the pieces too small for building purposes; this is used for road-metal still, but not very extensively, for slag from furnaces and Hartshill stone find their way almost everywhere now, the former of these two being very inexpensive, and the latter much superior for public roads where there is considerable traffic. Of course, the harder portions of the Rock-bed have also been used for road mending.

It might be thought that since the Marlstone Rock-bed has been so largely used for several purposes, quarries would

be plentiful, but they are not so. The stone is so easily obtained where it is used, and dug to such an inconsiderable depth, that a quarry may be opened for a particular purpose, such as building a house or mending a private road, and then closed again and grassed over. So quarries appear and disappear with the exigencies of the district.

The only other hard bed of the Middle Lias used for economic purposes is the bottom one, "L" of typical section. Considerable quantities of this have been used in the south-western parts of the county for road making, for which purpose it is probably better adapted, as it there occurs, than the Rock-bed. It used to be largely quarried at Overthorpe. As was pointed out in the description of this bed given in Part I., it alters very much in a direction at right angles to the strike. Some of this bed was recently extracted in making headings in a well at Messrs. Phipps and Co.'s brewery at Northampton, and it was partly used for repairing a road. But although exceedingly hard, so much so as to require blasting in order to extract, it proved to be a very inferior stone for road making. Under ordinary atmospheric influences and a small amount of traffic it was reduced to a powder. This, however, was not equal in quality to the stone from the same bed further west. Frost and the chemical changes set up in the green ferruginous matrix by weathering may probably be credited with the easy disintegration of the stone.

Ironstone.—The Middle Lias Rock-bed of the Midland Counties is the equivalent of the "Pecten Seam," or the "Cleveland Main Seam" of ironstone in Yorkshire, and hence the prevalence in it of a considerable quantity of iron is what might be expected. The stone is rich enough in iron in the south-western parts of Northamptonshire to have induced speculators to commence quarrying it for smelting purposes, but so far such works have not been successful, although in Oxfordshire to the south-west and Leicestershire to the north-east, such undertakings are yielding good results.

Some years ago (1874) extensive preparations were made by a company, under the title of the "Nell Bridge Iron Ore Company," for working a bed of this ironstone in the parish of King's Sutton, about four miles south of Banbury, by the side of the Great Western Railway. Very little came of the attempt, and the quarry has been untouched for some years. The circular issued by this company describes the ore as purely oolitic, yielding thirty per cent. of metallic iron, and thirty-three per cent. of lime, the proportion of lime being

sufficient for the ore to flux itself, and making it especially valuable for mixing with refractory ores. What the particular cause of failure at King's Sutton was, I am not in a position to say, but only a little over a mile from this spot; at Adderbury in Oxfordshire, the stone is extensively worked. It seems at least improbable that within this short distance the stone can have so far altered in character as to render its working unprofitable.

According to Mr. Thomas Beesley, F.C.S.,* the average percentage of iron in the King's Sutton stone is higher than that in the Adderbury stone, for specimens of the former yielded from 18·7 to 34 per cent. of iron, whereas some of the best specimens of the latter only yielded from 18 to 24 per cent. It appears, therefore, that the statement which occurs in Professor Phillips' "Geology of Oxford and the Valley of the Thames," that the Adderbury stone yields one ton of iron to three tons of stone, and that 30,000 tons of iron to the acre might be reckoned upon, requires modifying. Mr. Beesley further states that the richer stone at King's Sutton is sandy, but that the phosphatic concretions are sufficiently abundant to pay for picking out.

I do not anticipate that the Marlstone of Northamptonshire will ever be much used as an ironstone. It is rather remarkable that here, as in Yorkshire, and, I believe, Leicestershire, the quantity of iron in the Rock-bed diminishes with a decrease in the thickness of the bed. Thus the average thickness for Northamptonshire is about six feet, but the instances in which it is less are numerous; whereas in the south-western parts of the county, where alone it has been used, the thickness is about twelve feet.

It is unnecessary to enter largely into a consideration of the condition of the iron in the Middle Lias of Northamptonshire, considering that there is such a small prospect of its being used as a source of iron. Suffice it to say that the grey, green, or greenish blue colour of the unweathered portions of the Rock-bed, and parts of some of the other beds, is due to carbonate of iron chiefly, modified by the presence of phosphate or silicate of the protoxide of iron,† or both, the blue tint where present being particularly due to the former.

* "A Sketch of the Geology of the neighbourhood of Banbury," by Mr. Thomas Beesley, F.C.S.

† The green colour is usually regarded as due to an earthy mineral, called glauconite, which consists essentially of the hydrous silicate of iron and potash, but often contains magnesia, or other things.

The sometimes green oolitic character of the rock has been described as due to grains of silicate of iron; this may be so in some cases, but, so far as my experience goes, it is more often due to concretionary particles of carbonate of lime, coloured only with the silicate or phosphate of iron. This is also the general character of the matrix of bed "L" as found near Northampton.

The weathered portions of the ironstone are richest in iron, and, therefore, most preferred, chiefly because the carbonate of iron has been oxidised, and converted into the brown hydrated peroxide by aid of the gases dissolved in percolating water, and the calcic carbonate partially removed by the same water. The stone in the immediate neighbourhood of cracks and fissures, at least in superficial beds, always shows this same change of appearance and composition.

There are some hard stone beds near the base of the Upper Lias with intercalated clay beds, which, over much of the district marked as Marlstone in the maps of the Geological Survey, cover the Rock-bed. These beds, by affecting the intake of water, and consequent weathering of the Rock-bed, have considerably influenced its character as an ironstone or building stone.

The whole of the Middle Lias, as we have considered it, is ferruginous, and some of the thinner hard beds in the "*Margaritatus*" *Zone* are decidedly rich in iron, but because of their thinness and variability, they require little consideration. The top bed of the "*Margaritatus*" *Zone* in Yorkshire is worked as an ironstone under the name of the "Bottom Seam" or "Avicula Seam," but we have nothing which could be identified with it on that account.

The thin layers of ironstone found in the "*Spinatus*" *Zone* at Market Harborough, and in the "*Margaritatus*" *Zone* in some other places, exhibit, in addition to concretions, the cellular or box-like characters met with so commonly, and on a large scale, in the Northampton sand. The casings are highly ferruginous, but they generally contain clay or other matter in the interior. They are supposed to have been formed by the transfusion of the ferruginous matter from the interior outwards.

Agriculture.—The marlstone yields a rich red soil, well adapted to the growth of corn and other cereals, and also root crops, and being very porous, it suffers very little from wet seasons. It is probable that the richness of these red lands is largely due to the phosphates, so often present in the Rock-bed. Commonly near the base of this bed flattened argillaceous nodules occur in considerable abundance,

sufficiently so to give the rock a conglomeratic appearance; these concretionary nodules are rich in phosphates; indeed, they might perhaps be ground and employed with advantage as a dressing for other lands. Phosphoric acid is, however, met with in most parts of the Rock-bed, and as has been pointed out before, it is probably the cause of the bluish appearance of the unweathered stone. This is the more evident from the fact that two or three times I have found pieces of the Rock-bed coated with a bright blue incrustation, which, on analysis, proved to be nearly pure phosphate of iron (Vivianite). I have found such stones in the neighbourhoods of Thenford and Edgcott.

Lime.—Sometimes the Rock-bed is burnt for lime, though I know of no instance in which it has been in Northamptonshire. The presence of any considerable quantity of argillaceous or siliceous matter would no doubt be detrimental to this mode of treatment, but where these were not considerable, the lime produced might reasonably be expected to be more valuable for agricultural purposes than that made from the ordinary Great Oolite limestone of the district, because of the phosphoric acid present.

(To be continued.)

THE MONUMENTAL BRASSES OF WARWICKSHIRE.

BY E. W. BADGER, M.A.

(Continued from page 275.)

WELLESBOURNE-HASTINGS.—*Sir Thos. le Straunge, Constable of Ireland*, 1426, *with SS. collar. Haines.*

This particularly neat, soldierly-looking, effigy is about 2ft. long, and lies in the chancel. The knight is clad in *a complete suit of plate armour*, not a link of mail being visible; compare the brass at Wixford. The most noticeable features of this brass are the collar of SS. (see description of the brass at Baginton), the skirt of six overlapping plates called *taces*, and the shield-shaped plates at the armpits, which take the place of the usual *roundels*.

At the four corners of the stone are shields, two plain and two emblazoned with the arms of Le Straunge, gu., two lions pass. in pale arg., crowned or.

The following is the inscription, which has been restored:—

Hic iacet dominus Thoms le Straunge miles | nuper Constabularius Regis in Hibernia qui obiit | tertio die Maii Anno domini mcccc | xxvi et regni Regis Henrici sexti quarto cuius animæ ppitietur deus.

Translation:—

Here lieth Sir Thos. le Straunge, Knight, late the King's Constable in Ireland, who died on the 3rd day of May, A.D. 1426, and in the 4th year of the reign of King Henry VI.: to whose soul God be merciful.

Dugdale gives an engraving of this brass.

WESTON-UNDER-WEATHERLEY.

I.—*Inscription. Anne Danet*, 1497. *Haines.*

Of this memorial, which is upon the chancel floor, nothing but the inscription remains, upon a plate about 18½in. by 6½in. Dugdale gives an illustration showing an effigy and shields of arms, and the matrix of a child's figure. At the top left corner of the stone is the matrix of a shield; the other matrices are not visible, and may have been filled up with cement. Inscription:—

Here lyeth Anne danet wyf of Gerard danet Gentilman | doughter & oon of the heires of John buggefford lord of | Edmondescote Wolffrichstone & Merston Wapenbury Wolstorp | & Eythorp in the countes of Warr & leyscet, which Anne | decessed the xviii day of August the yere of or lord god mo cccclxxxxvii. On whose sowle Jhū have mcy amen

II.—*Inscription. Margaret, w. of Sir Edw. Saunders, knt.* 1563. *Haines.*

A large plate, 2ft. 5in. by 22in., inlaid in a Purbeck moulded panel, at the end of the north aisle. At the top of the plate are engraved the arms of SAUNDERS Per chev., sa. and arg., three elephants' heads erased, counterchanged, and tusked or.; ENGLEFELD, THROKMORTON, and DANVERS.

Below these are the following Latin elegiacs:—

MARGERIE SAVNDERS ARTVS SVNT MORTE SOLVTI,
PERPETVA FÆLIX MENS REQVIETE JACET.
DONEC ENIM VIXIT CŒLESTIA SEMPER AMABAT,
ASSIDVA VENERANS RELIGIONE DEVM.

Cōivgis Edwardi casto flagravit amore,
Prefvit et magna cvm ratione domi.
Morbvs et exhavstvm corpvs cvm frangere cæpit
Ad dominvm ivnctas svstvlit illa manvs.
Inde crucis Christi simvlachrvm læta poposcit,
Hoc ocvlis animo sensibvs ægra notat.
Hinc neqvit evelli mens in meditando trivmphans,
Atqve svvm colvit non saciata devm.
Egregiam vitam mors est præclara secvta;
Margerie fælix vitaqve morsqve fvit.

And for the benefit of those who do not read Latin the following translation comes directly below the elegiacs:—

Here Margery Savnders lieth whose mortall lymes ar dede
Bvt to enioy imortall rest her sowl to Heavē ys fledd.
Whyles lyf did last she was a paterne of good lyfe,
Devowte to God, good to the poore, a chast ād perfit wyf.
A howswyf of great skill, settinge her hole delight
In her iust love ād wedded mate sr Edward Savnders Knyght.
For Christ his crose she calld amiddis the pangis of death
Which she with mind and ie behelld ṽtill her later breath
And so gave vp her gost to God which lyf did lend
Who for her good and worthi lyf gave her a happi end

The corps of Dame Margerie Saṽders dawghter of sr Thomas | Englefelde Knyght ād of Dame Elizabeth his wyf on of ye | Davghters of sr Robert Throgmortō Knight lieth ī this tomb | Whos sovl God pdō she died ye 11 of Octobris Ao Dn̄i 1563.

"Sir Edward Saunders Knight" is described on a tablet of alabaster on the north wall as "sometime Chief Justice of England, and after Chief Baron of the Exchequer."

III.—*Inscription. Joyce Tomer*, 1566. *Haines.*

A small plate, 18in. by 8½in., on the south wall of the chancel. Joyce Tomer was evidently Sir Edw. Saunders' family doctor, for the inscription says:—

Artis · Apollīee · fveras · qvi · mista · iodoce :
Hev · mortis · iacvlo · victe · Tomere · iaces :
Cvivs · in · interitvm · tvlit · hec · solatia · tristem :
Savndervs · vere · pignora : : amicitiæ (*scroll*)
(*cinquefoils*) Anno · Dm̄i : 1566 : Decembris 22 (*scroll*)

Then in very elegant Gothic characters is appended this translation :—

Heare · lyeth · Joyce · Tomer · slayne · by · death :
That : : had : : of : : physsicke : skyll : : (*scroll*)
Whose : losse : these : comfortes · Saunders · shewes :
As : : tokens : : of : : good : : wyll : : (*scroll, &c.*)

The word "mista" is of course a Latinised form of the Greek μύστης, "one initiated."

WHATCOTE. — *Wm. Auldington, parson,* 1511 (?). *Haines.*

In the chancel is the figure of a priest, about 15in. high, head lost, vested for mass (see COLESHILL, TYSOE, WARWICK), and holding a chalice. The drawing is coarse.

Upon a plate, $9\frac{1}{2}$in. by $2\frac{1}{2}$in., is inscribed :—

pray for the sowl of Sr. Wyllm Aul | dington somtyme parson here | on whos sowle ihu have myrcy.

Wm. Auldington was succeeded at Whatcote by Robt. Maud in 1511 (see Dugdale), and probably died in that year.

WHICHFORD.—*Nich. Asheton, rector,* 1582. *Haines.*

Of this effigy, which is 18in. high, Mr. M. H. Bloxam says it portrays Nicholas Asheton "habited in the cassock, open in front, but with sleeves wide at the wrists, so as to display his doublet; over the cassock, however, is worn the sarcenet tippet (the so-called scarf of modern days)." ("Trans. of Archæolog. Sect. of Mid. Instit.," 1874, p. 18, where also an engraving of the brass will be found.) This post-Reformation brass should be compared with that of Sir John Fenton, at Coleshill, and here it should be added that Mr. Bloxam considers that the latter is vested in a cassock, and not in a Genevan gown.

There is a shield of arms at each corner of the tombstone, and the following inscription beneath the effigy, upon a plate, 20in. by $5\frac{1}{4}$in. :—

Hic Jacet Nicolaus Asheton sacræ theologiæ Baccha=laureus | Cantabr : Cappellanus Comitis Darbie : Nuper Rector istius | Ecclesiae : ac olim vicarius de kendalle Lancastrensis apud | magnā leaver : qui obiit ultimo die mensis Septembris Anno | dni Millessimo quingentessimo octogessimo secundo regni | Elizabethae Reg : vicessimo quarto

Translation :—

Here lieth Nicholas Asheton B.D. of Cambridge, chaplain of the Earl of Derby, late rector of this church, and sometime vicar of Kendal near Great Leaver Lancashire: who died on the last day of September A.D. 1582, being the 24th year of the reign of Queen Elizabeth.

An engraving of the brass will be found in Bloxam's "Gothic Architecture," p. 254.

WHITNASH. I.—*A Civilian and w., circ.* 1500. *Probably Benedict Medley, Clerk of the Signet to Henry VII. Haines.*

This brass is now mural, in the chancel. The figures are about 2ft. high, and represent a civilian with long hair, a loose fur-lined gown with wide sleeves, and a closely-fitting under-tunic; and a lady with the kennel head-dress, a long flowing gown with tight sleeves having fur at the cuffs, and a waist-band fastened with a large buckle, the loose end falling as low as the feet. A modern inscription has been placed beneath the figures, which says, "The above figures of Benedict Medley and his wife were fixed here at the restoration of the chancel 1856. He was Clerk of the Signet to King Henry VII., and Lord of this Manor. He died A.D. 1504 and was buried with his wife in this church."

According to Dugdale, the manor was sold to Benedict Medley by Sir Henry Willoughby, grandchild of Sir Hugh Willoughby, the first husband of Margaret, wife of Sir Richard Bingham, whose brass is at Middleton. Sir Henry Willoughby was father of Dorothy Fitz-Herbert, whose brass also at Middleton (see above).

II.—*Rich. Bennet, M.A.*, 1531. *Haines.*

A figure, 17in. high, of a tonsured priest, vested for mass and holding a chalice, above which is a wafer. This figure is peculiar in not having a *maniple*, and should be compared with the effigies of W. Abell at COLESHILL, and R. Willardsey at S. Nicholas', WARWICK.

Upon a plate 23in. by 4in. is the following inscription :—

Hic loci sepelitur dm̄n̄s Richardus Bennet artis laice magister | atq. huius quonda̅ ecclesie diligens pastor qui fatis co̅sessit | viii die me̅sis Januarij an̄o dn̄i mcccccxxxi cuius misereatr de.

Translation :

In this place is buried Sir Richard Bennet, M.A., formerly the faithful pastor of this church, who paid the debt I nature on the 8th of January, 1531. On whom God have mercy.

The chalice now used in the church is a faithful copy of that represented on this brass.

III.—*Inscription. Nich. Greenhill, M.A., Rector*, 1650.

This is a small brass plate, not mentioned by Haines, upon the north wall of the chancel. It bears the following verses, composed by Richard Boles, M.A., rector of the church in 1682 :—

This Green hill Periwigd with Snow
Was leauild in the Spring :
This Hill ye Nine & Three did know,
Was sacred to his King.
But he must downe, although so much divine,
Before he Rise never to set, but shine.
RĪ. BOLES. MR. ART. 1682.

IV.—*Inscription. Rich. Boles, M.A.* 1689.

A small plate, 7in. by 4½in., similar to and near the last, and not mentioned by Haines.

Richard Boles seems to have been fond of writing epitaphs, and composed his own some time before his death. He says :—

This mirrour makes me slight a life half done,
Because a Better comes when this is Fled ;
The Time and Place where I doe live are knowne
My Death and Grave none knowes but God alone.
My Death is Certain and Vncertaine : Then
Mortalls beware, Death comes you know not when.
I value not a Tombe ; Obscure to lie
With Virtue is an Immortalitie.
My Life runns on Five yeares beyond Four Score,
Once I must die and then shall die no more.
RĪ. BOLES. Ano. Dni. 1689. Ætat. meæ 85.

WITHYBROOK.—*A civilian, circ.* 1500.

I am indebted to Mr. W. S. Brassington, of Moseley, Birmingham, for a rubbing of this brass. It is in the nave,

and measures $16\frac{1}{2}$in. It represents a civilian, and closely resembles the brass of Benedict Medley at Whitnash, which see. There are matrices for a lady, two groups of children, and an inscription, the brass plates being lost. A full description of the brass will be found in the "Local Notes and Queries" column of the *Birmingham Weekly Post*, Feb. 27th, 1886.

Dugdale mentions brasses at Withybrook to Richard Wright and wife, 1501, and to Christopher Wren and wife, 1543. It is impossible to say whether this is part of one of these memorials.

(To be continued.)

EDELWEISS.

Take, dear Lady, take these flowers
Children born of sun and showers.
Summer sun and winter snow
Crushed the rock from which they grow;
Strength of immemorial chalk
Fed the fibres of their stalk;
Lightning, hurricane and storm
Shaped their pliancy of form;
Gleam and gloom with varying sway
Stained their petals ashen grey,
Which, like loving hearts, enfold
In their midst one spot of gold.
Fearless head and steady foot
Tracked the cradle of their root.
Now a link in friendship's chain
From the mountain to the main.
Nurslings of the central sea,
Such as late I gave to thee,
Lull the senses, charm the eye,
Bloom and wither, breathe and die.
These, by sterner process made,
Slow engendered, slowly fade.
And they bring where'er they fare
Just a whiff of Alpine air.
Lady, take these simple flowers,
Emblem meet of sun and showers.

Oscar Browning.

Macmillan's Magazine, October, 1886.

METEOROLOGICAL NOTES.—September, 1886.

Atmospheric pressure was unsteady, but the mean for the month was above the average. On the 16th the mercury reached 30·543 inches, the lowest reading being 29·609 inches on the 10th. Temperature was about one degree above the average. The maximum readings were generally high, and the minima in no instance so low as usual. The range was occasionally very small. The highest observed were 80·0° at Henley-in-Arden, on the 14th; 74·7° at Loughborough; 73·5° at Hodsock; and 73·0° at Strelley, on the 4th; and 72·8° at Coston Rectory, on the 1st. In the rays of the sun, 135·4° at Loughborough, on the 13th; 124·3° at Hodsock, on the 5th; and 122·1 at Strelley, on the 1st. The lowest minima were 34·8° at Hodsock, and 37·0 at Henley-in-Arden, on the 16th; 37·5 at Coston Rectory, on the 11th; 39·0° at Loughborough, on the 23rd; and 40·1 at Strelley, on the 11th and 16th. On the grass the mercury fell to 30·4° at Hodstock, on the 16th; and to 33·2° at Strelley, and 33·7 at Loughborough on the 23rd. In 1885 the sheltered thermometer registered 30·4° at Loughborough, on the 28th September. The rainfall was less than in any of the last eight years, though but slightly different from that of September, 1884. The total values were, 2·09 inches at Henley-in-Arden, 1·54 inches at Coston Rectory, 1·15 inches at Strelley, 1·09 inches at Loughborough, and 1·01 inches at Hodsock. The number of "rainy days" varied from ten to fifteen. The atmosphere was rather drier than usual. Sunshine was very deficient. Lightning was observed at Coston Rectory and Loughborough, on the 4th. The weather was favourable to harvest operations, which were, for the most part, completed before the end of the month.

Wm. Berridge, F.R. Met. Soc.

12, Victoria Street, Loughborough.

Reviews.

The Flora of Oxfordshire; being a Topographical and Historical Account of the Flowering Plants and Ferns found in the County. By George Claridge Druce. 8vo, pp. 53-451; 10s. 6d.—Oxford: Parker & Co.

This is a most ably compiled Flora and a valuable addition to British botanical literature. Treating, as it does, of a county which can boast, not only of a rich and varied Flora, but also of having had amongst her workers, botanists whose names are historic, whose published works are among our classics, the greatest of our botanical luminaries, this work cannot fail to interest all who love the fascinating science of botany. Throughout the work there is evidence, not only of truly industrious and discriminating field work and critical observation, but also of a thorough acquaintance with the past literature and work pertaining to Oxfordshire botany.

The introduction comprises an able account of the topography, geology, and drainage of the county, and a full description of the seven botanical districts which are based on the river drainage. To each of these districts is added a full list of the more noticeable plants that are peculiar to the district. To this are also added observations on the meteorology and temperature of the county, followed by the plan of the Flora, list of books, MSS., etc., quoted in the work, principal Herbaria quoted, and list of principal persons who have contributed notes or rendered assistance in the preparation of the Flora.

The Flora proper, which occupies some 366 closely-printed pages, then follows. In this the author gives the localities for each district of the more local plants, also frequent personal notes on their special peculiarities, and, what is most interesting, copious notes from the older authorities and from the numerous works that have been consulted in compiling the work; noticing, also, in many instances, the occurrence of the plant in the contiguous counties of Berks, Bucks, Warwick, Northants, and Gloucester. This is followed by a careful summary, giving the classes of citizenship, from which we find that the native plants of Oxfordshire number 818 species.

Denizens	49
Colonists	43
Total	910
Extinct	17
Ambiguities and errors	19
Casuals and aliens	169

About 310 varieties have also been noticed.

Under the head of aliens and casuals the author has probably included several plants scarcely worth noting in a Flora. The following are the types of distribution:—

	Great Britain.		Oxford.
British	532	..	469
English	409	..	308
Intermediate	37	..	8
Scottish	81	..	7
Highland	120	..	—
Germanic	127	..	51
Local or doubtful ..	49	..	9
Total	1,355		852

Comparative notices are also given of the contiguous counties, by which we find that 85 species occur in Warwickshire that have not been found in Oxfordshire, whilst Oxford has 88 species not at present recorded for Warwickshire

Then follows a most interesting and pleasantly-written chapter on Oxfordshire Botanologia, in which are given biographical notices of the various botanists who have been associated with Oxfordshire botany, from Turner, the father of British botany, to the most recent of her workers. Among the more noticeable appear Gerarde, Parkinson, Bobart, Sherard, Dillenius, Sibthorp, Lightfoot, Banks, Goodenough, Baxter, and also other more or less historic names.

The work concludes with the mosses and hepatics of Oxfordshire, which is a full and possibly exhaustive account of the various species and varieties, with their localities, by one of our leading bryologists, Mr. Henry Boswell. There are also catalogue lists of the fungi and lichens that have from time to time been recorded, and a very useful map, so coloured as to show at a glance the different drainage districts. The work is printed in small but clear type, is attractive in appearance, and does credit to both author and publisher.

J. E. Bagnall.

Nature-Musings; on Holy-days and Holidays. By the Rev. Nehemiah Curnock. With an Introduction by the Rev. W. H. Dallinger, LL.D., F.R.S. London: T. Woolmer.

The fact that this delightful little book is introduced to the reader by Dr. Dallinger is a sufficient guarantee that it is worthy his attention. The author, a Wesleyan minister, who "believes that all knowledge of God's works is helpful to faith and Christian usefulness," writes with the object of attracting young people to a study of Nature. This he seeks to do by describing the habits and structures of various "common objects" of English shores and ponds, lanes and gardens, justifying the publication of a new book on such familiar matters, by the fact that our best naturalists tell us that even the commonest phenomena of Nature cannot be too frequently described, provided the work is done truthfully. As might be expected, he writes from a purely religious standpoint, "Bible in hand," and explains everything by the theory of special creation, but all in a simple yet most genial and attractive manner. Now he tells us about the Polyzoa and Hydroids found on the sea-weeds attached to the pier at Bournemouth, now he takes us to certain "Cheshire water-worlds" rich in animal life, or again, discourses on the fortunes and misfortunes of a "Disinherited whelk," and everywhere with a light, graceful, and scholarly touch. An example will best show his general style; he is talking about the "bird's head processes" of certain Polyzoa:—

"But what is the meaning of these *vulture-heads* placed at intervals on the stalks. Imagine a crystal hare-bell of gigantic size, with the head of a vulture fastened to the stem just below the flower. No legs or wings or body; nothing but an awful head! See! it rises, slowly; and then more quickly falls. But for its shape, it might be a passing bell, ringing out in measured tones some awful doom. And ever and anon, as that solemn head rises, the beak opens wider and wider."

There are various illustrations of average merit, while the printing and paper are all that could be desired. We would suggest that if a second edition be reached, a good index should be added, as at present it is very difficult to find the place where any given animal is described. In conclusion, we heartily recommend this book, not to young people only, but to all who are as yet unacquainted with the wonders of the organised world.

A. B. B.

Natural History Notes.

Mildness of the Season.—Laburnums bloomed in many places during October. On October 6th and 11th ripe strawberries were gathered out of doors in a garden near Maidstone. About the same time "a magnificent lot of raspberries, quite in perfection," were picked in the garden of Corner Hall, Hemel Hempstead. Similar reports come from several other districts. At Hemingford, St. Ives, a second crop of raspberries was gathered on the 12th, "accompanied with the song of the thrush and the blackbird."

Burnt Earth for Alpine Plants.—Mr. Geo. Maw, F.L.S., has published an interesting note on this subject in the *Gardener's Chronicle*, October 16th. Plants which grow naturally in fissures only, such as many of the hard-foliaged Saxifrages, Androsaces, etc., are, it is well known, very difficult to maintain in health in gardens. It is with plants of this class that Mr. Maw has been experimenting for three or four years. He finds that when grown in pulverised fire-brick refuse (technically known as "ground sherds"), with a very slight admixture of peat and loam, they thrive admirably. Pulverised red brick produced very similar results, but the preference is given to the fire brick.

Plant Food.—Mr. Edmund Tonks, B.C.L., recently delivered an interesting and instructive lecture on this subject to an audience of practical gardeners in Birmingham, in the course of which he pointed out the value of artificial manures, and gave much useful information about them. The lecture has been printed, and may be obtained from Messrs. Cornish Brothers, Birmingham. The price is sixpence.

Wasps.—A number of letters have appeared in the newspapers remarking on the almost entire absence of wasps this autumn in the Midland Counties. This agrees with our own experience, for we have seen only two or three at most. Various reasons have been assigned for their scarcity, the most feasible being the prevalence of cold, bitterly cold, east winds during April and early in May; and several successive wet days in May, which drowned or destroyed their nests. Up to the first week of May, queen wasps were very abundant. In some districts we learn that wasps have been as numerous as ever, and one writer ("D. T. F." in *The Garden*, Oct. 9th) says that in East Anglia on Oct. 4th he saw large quantities—"many thousands" is his expression—swarming among the open flowers of ivy, although during the season he has destroyed "fifty nests and occupants."

Toadstools.—It is a very old-established belief in many districts that toads commonly sit upon fungi; this idea has arisen from a misunderstanding of the meaning of the word "toadstool" or "paddock stool." One meaning of the word "paddock" is "toad," and in old times, when the toad was looked upon as ugly and venomous, poisonous fungi were supposed to arise spontaneously from its dung; the second syllable, "stool," being really the old word which is synonymous with dung, or the place where dung is laid down.—Worthington G. Smith, in *The Gardening World.*

Botanical.—Mr. J. D. Siddall, of Chester, has recently had printed for the use of students a "Classification of the Vegetable Kingdom, showing the position therein of the British and some of the larger exotic Natural Orders of Plants, with abbreviated details of the floral structure of each." This is printed on one sheet, demy, and includes 120 natural orders from Ranunculaceæ to the lowest forms of the Cryptogamia. It is very ably compiled, and will be of the greatest service to students preparing for examination.

The British Association.—The following important Committees on subjects of local interest were appointed at the recent Meeting in Birmingham, on the recommendation of the Committee of Section D, Biology:—

"That Mr. Valentine Ball, Mr. H. G. Fordham, Professor Haddon, Professor Hillhouse, Mr. John Hopkinson, Dr. Macfarlane, Professor Milnes Marshall, Mr. F. T. Mott, Dr. Traquair, and Dr. H. Woodward be a Committee for the purpose of preparing a report upon the Provincial Museums of the United Kingdom; that Mr. Mott be the Secretary, and that the sum of £5 be placed at their disposal for the purpose."

"That Professor Hillhouse, Mr. E. W. Badger, and Mr. A. W. Wills be a Committee for the purpose of collecting information as to the Disappearance of Native Plants from their local habitats; and that Professor Hillhouse be the Secretary."

"That Professor Milnes Marshall, Dr. Sclater, Canon Tristram, Dr. Muirhead, Mr. W. R. Hughes, Mr. E. de Hamel, and Professor Bridge be a Committee for the purpose of preparing a report on the Herds of Wild Cattle in Chartley Park and other parks in Great Britain; and that Mr. W. R. Hughes be the Secretary."

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—Meeting, October 5th. This being the opening of the session, the Chairman and President, Mr. R. W. Chase, gave an interesting address, in which he drew the attention of the members to the necessity for taking further steps to foster the love of natural history, and said he could assure the members that no efforts would be spared by the committee to ensure interesting and instructive meetings. He insisted upon the necessity of the hearty co-operation of the members who were capable of giving papers and otherwise assisting in the practical work of the society, and said that the interest shown by the visitors to the natural history annexe of the

exhibition at Bingley Hall clearly demonstrated that there was a desire among people generally to become better acquainted with natural history. One of the great wants of Birmingham was a good natural history museum, and he trusted that the time was not far distant when it would possess such a museum. He announced that Mr. Morley, who had filled the office of honorary secretary to the society for upwards of twelve years, was compelled to retire for a time from those duties he had so well performed, and referred to the many obligations which the society was under to Mr. Morley for his untiring work in their interests. He trusted that the well-earned rest which Mr. Morley would now enjoy would enable him so to improve in health that the members might soon see him again among them. Mr. John Udall had been appointed to act as deputy secretary till the end of the year.—Mr. R. W. Chase exhibited Bluethroat, *Cyanecula suecica*, shot at Blankeney, Norfolk, Sept., 1884; dipper, *Cinclus aquaticus*, Richmond, Yorkshire, Aug. 8th, 1884, showing white feathers in wings and tail, an unusual occurrence in this species; black-bellied dipper, *Cinclus melanogaster*, Humber Bank, Lincolnshire, Oct. 24th, 1885; St. Kilda wren, female, *Troglodytes hirtensis*, St. Kilda, July 10th, 1886; Kentish plover, male and female, *Ægialitis cantiana*, Breydon Flats, Norfolk, April 29th, 1886; great snipe, *Gallinago major*, near Yarmouth, very rare in spring. Birds in down.—Hobby, *Falco subbuteo*, Weethley Wood, near Alcester; Arctic tern, *Sterna macrura*, common tern, *Sterna fluviatilis*, Farne Islands; and little tern, *Sterna minuta*, Towyn. Nests and eggs.—Reed warbler, *Acrocephalus streperus*, two nests placed one above the other upon the same reeds, both nests containing eggs, with the addition of a cuckoo's egg in the upper nest, Ely, June 22nd, 1886; grasshopper warbler, *Locustella nævia*, Blaydon, June 9th, 1886; peregrine falcon, *Falco peregrinus*, Isle of Lewis, April 5th, 1886; merlin, *Falco æsalon*, Isle of Lewis, May 21st, 1886; common teal, *Querquedula crecca*, Norfolk; garganey teal, *Q. circia*, May 1st, 1884, Hickling; whimbrel, *Numenius phæopus*, Shetland, May 24th, 1885. Prof. W. Hillhouse, M.A., exhibited an ingenious apparatus to measure the amount of water given off by the leaves of a plant. Dr. Crooke exhibited tubercle bacilli, in a lymphatic gland from the horse; bacilli, stained red, shown under a Zeiss $\frac{1}{12}$ oil immersion objective; also, anthrax bacilli, in the lung of a mouse. Mr. Horace Pearce, F.G.S., exhibited granites from Aberdeen, and other rock sections, amongst which were the following: granite, very micaceous, and jasper, from the shore, Aberdeen; and granite from Peterhead, prepared by G. Healey, Esq., Bowness. Lepidodendron, tree stem from coal measures, Halifax; and Sternbergia, fossil stem of tree, from Oldham, Lancashire. Mr. W. B. Grove, B.A., exhibited the following fungi, from the neighbourhood of Birmingham: *Lactarius torminosus*, *L. vellereus*, *Boletus badius*, *B. piperatus*, *Agaricus heteroclitus*, *Ag. cervinus*, *Ag. testaceus*, *Russula integra*, *R. citrina*, *R. ochroleuca*, *Hygrophorus chlorophanus*, *Hydnum repandum*, *Ag. speciosus*, *Marasmius peronatus*, and an abnormal form of *Polyporus sulphureus*. Mr. F. J. Cullis, *Dipsacus Fullonum*, the fuller's teasel, compared with *Dipsacus sylvestris*, the common teasel. Mr. T. Bolton, *Corethra plumicornis*, developed from pupa of glass larva in the Bingley Hall Exhibition; *Pterostylaria parasitica*, called by some the polite worm, from its graceful movement; *Stephanoceros Eichhornii*, *Floscularia ornata*, *Leptodora hyalina*, *Plumatella repens*, &c. Mr. W. H. Wilkinson, *Anacharis alsinastrum*, showing the circulation of cell contents; also, sections of the following lichens: *Solorina saccata*, showing the spores *in situ*; *Collema granulosum* and *Lecidea sanguinaria*, both being double

stained. Mr. W. P. Marshall, M.I.C.E., Mr. J. Edmonds, and Mr. J. Udall were also amongst the exhibitors. BIOLOGICAL SECTION, October 12th, the President in the chair.—Mr. W. R. Hughes, F.L.S., exhibited the fruit of the sumach. Mr. W. B. Grove exhibited the following fungi: *Ag. muscarius*, *Ag. flavo-brunneus*, *Ag. columbetta*, *Ag. jubatus*, *Ag. sericellus*, *Ag. lampropus*, *Ag. pennatus*, *Ag. mesophæus*, *Cortinarius torvus*, *C. bolaris*, *C. paleaceus*, *Gomphidius gracilis*, *Russula depallens*, *Lactarius pyrogalus*, *L. torminosus*, *Clavaria inæqualis*, *Lycoperdon cælatum*, and *Ræstelia cancellata*, from various places in Warwickshire; (for Mr. C. T. Parsons) *Ræstelia cancellata*, from Pershore, Worcestershire; (for Mr. J. Hamson) *Ag. clavipes* and *Ag. semiorbicularis*, from Bedford. Mr. W. P. Marshall exhibited *Tubularia indivisa*, *Coryne pusilla*, *Plumularia pinnata*, *Noctiluca miliaris*, *Obelia dichotoma* and gonozoids of the same, zoëa of barnacle, larvæ of crab and shrimp, and young hermit crab, all mounted specimens, made during the Tenby excursion. Mr. J. Potts exhibited thirty-seven photographs of places in Pembrokeshire, taken during the same excursion. Mr. R. W. Chase exhibited the razorbill, *Alca torda*, adult male; common guillemot, *Lomvia troile*, adult male, also in down, and eggs; ring-eyed guillemot, *Lomvia lacrymans*, adult male, all in breeding plumage; black guillemot, *Uria grylle*, adult in summer plumage, and young in winter plumage, also adult changing to winter; little auk or rotche, *Mergulus alle*, male in winter plumage; puffin, *Fratercula arctica*, adult female in summer plumage, and young in first plumage; also, four photographs of the guillemot colony on the Pinnacle Rock, at the Farne Islands, and a photograph of the egg of the great auk, *Alca impennis*, natural size. Mr. W. P. Marshall then read the "Report of the Excursion to Tenby, in June, 1886," which will be printed in due course. MICROSCOPICAL GENERAL MEETING, October 19th. Mr. W. B. Grove in the chair. Mr. Bolton exhibited (for Mr. B. W. Westwood) an abnormal growth of pear, a small pear growing out from the centre of a larger one. Mr. Thos. Clarke exhibited joints of the stem of an encrinite, probably *Poteriocrinus crassus*, from the lower carboniferous limestone, Holy Island; these are called "seals" by the natives, and used as such; they attribute to them a vegetable origin. He also exhibited a number of flies, bred from larvæ, which fed on a fungus belonging to the genus Russula, from Witton. Mr. W. B. Grove exhibited a very fine specimen of *Polyporus frondosus*, fourteen inches across and eight inches high, which grew at the foot of an oak tree in Hagley Park, and (for Mr. H. Hawkes) *Polyporus salignus* (new to the district), also *Ag. jubatus*, *Ag. melaleucus*, *Ag. glutinosus* (new), *Ag. chalybæus*, *Ag. mammosus*, *Ag. sinapizans* (new), *Ag. spadiceo-griseus*, *Hygrophorus pratensis*, *H. unguinosus* (new), *Clavaria fumosa* (new), *Fistulina hepatica*, *Bovista nigrescens*, and other fungi, from Hagley Park. A discussion ensued, in which Mr. J. Levick, Mr. W. H. France, and others took part.

LEICESTER LITERARY AND PHILOSOPHICAL SOCIETY. —SECTION D, ZOOLOGY AND BOTANY. Chairman, F. T. Mott, F.R.G.S. Monthly Meeting, Wednesday, October 20th. Attendance, ten (two ladies). The following objects were exhibited, viz.: By Mr. W. A. Vice, a number of fresh fungi, including *Schizophyllum commune*, a *Peziza*, *Hygrophorus niveus*, and several Agarics. By Mr. E. F. Cooper, pieces of dead sticks thickly covered with the beautiful pink fungus *Tubercularia vulgaris*. By Miss Grundy, a dwarfed specimen of *Campanula glomerata* from the Chalk Downs, and a pencil sketch of a beech tree

with several boughs naturally inarched and grown together. By Dr. Finch, specimens of *Helix ericetorum*, and *H. virgata*, from the Downs at Eastbourne; and a fine example of the pendant nest of a wasp on a branch of cedar of Lebanon, from the grounds of the borough lunatic asylum. The nest was nearly globular, about five inches in diameter, and when taken was deserted, the gardener having seen the wasps fly away in a body carrying something with them which appeared to be either eggs or larvæ. By the Chairman, dried specimens for distribution of *Erodium moschatum*, *Lamium hybridum*, &c. The Chairman, in the absence of the author, read a paper by Mr. H. E. Quilter on "The Metamorphoses of *Galereuca nymphea*, a coleopterous insect," describing the larvæ collected from the floating leaves of *Polygonum amphibium*, and the phenomena of their changes into pupæ and perfect beetles, carefully watched and recorded by himself. The Chairman remarked that this paper was a useful contribution to a branch of entomology, in which there was still a wide field for amateur work.

BIRMINGHAM MICROSCOPISTS' AND NATURALISTS' UNION.—September 20th. Mr. Deakin exhibited the jaws of a shark; Mr. Dunn (for Mr. Baxter) larvæ of *Orgyia pudibunda* and pupæ of *Grapta C. album*. Under the microscopes, Mr. Corbet showed *Tabellaria flocculosa*, a diatom from tap water; Mr. J. W. Neville, a plant bug, Tingis, from Turkey; Mr. H. Hawkes, *Isaria farinosa*, a fungus growing from the abdomen of a spider; Mr. Mulliss, anthers of *Malva moschata*.—September 27th. Mr. J. Madison exhibited continental specimens of land shells; Mr. A. T. Evans, a pebble from the Drift, containing several specimens of *Orthis budleighensis;* Mr. J. Harrison, a belemnite, illustrating the difference between ancient and modern cuttle fish—in the latter the phragmacone is missing, and the guard almost so; Mr. Wagstaff, Australian gum-enclosing insects. Mr. J. A. Grew then read a paper—"Notes on a Foreign Tour." The route taken was from Dieppe, through Rouen, Paris, and Nancy, to Strasbourg. The notes comprised sketches of the archæology, architecture, and natural history. The writer regretted that improvement schemes had coffined so many of the old houses of Rouen in the dust of the past. The cathedrals of Rouen and Strasbourg were particularly spoken of as monuments of architectural beauty. The natural history was not widely different from our own, except that some objects rare with us were abundant there. An account of the Lepidoptera seen by the way concluded an interesting paper.—October 4th. Mr. Deakin showed a specimen of *Pholadomya fidicula* and fossil wood from the Lias of Dorsetshire; Mr. Wagstaff, an improved microscope lamp with metal chimney, the advantages claimed for it being efficiency with economy; Mr. H. Hawkes, a number of fungi, including specimens of *Cortinarius helvolus*, *Clavaria vermiculata*, *Russula emetica*, and *Sphærobolus stellatus*. Under the microscopes, Mr. H. Hawkes showed a fungus, *Sporodinia dichotoma;* Mr. H. Insley, a section of *Aristolochia latifolia;* Mr. Mulliss, stained section of fern.—October 11th. Messrs. Deakin and Evans showed a coral, plant-remains, and other fossils in pebbles from the Drift; Mr. H. Hawkes, the following fungi:—*Dædalea quercina*, *Boletus badius*, *Clavaria inæqualis*, and *Agaricus prunulus*. The subject of the evening was Practical Microscopy—"Mounting whole Insects." Mr. J. W. Neville demonstrated the simplicity of preparing whole insects for microscopical investigation by describing and showing the processes they pass through. Several objects were prepared and mounted, and afterwards exhibited to the meeting.

ON A DEEP BORING IN THE NEW RED MARLS (KEUPER MARLS) NEAR BIRMINGHAM.

BY W. JEROME HARRISON, F.G.S.

The Triassic strata which form the country surrounding Birmingham consist of the usual divisions of sandstone and marl; the sandstones predominating below, the marls above. In the immediate neighbourhood of the town, the sandy beds are divided from the marly or clayey strata by a dislocation or line of fault which runs from north-east to south-west, taking a line from Erdington to Rubery, and traceable altogether for a distance of about twenty miles. The fault runs through the town of Birmingham nearly parallel to the River Rea, and from a quarter to half-a-mile west of the present bed of the river. The Lower Keuper sandstone, which forms a surface band one to two miles in width on the west of this fault, is a porous stratum about 200 feet in thickness. It is underlain by the Bunter Pebble Beds, 300 to 400 feet in thickness, which crop out further to the west, and which contain an inexhaustible supply of water. From three deep wells in the suburbs of Birmingham—two on the north at Perry and Witton, and one on the south near Selly Oak—the Corporation Waterworks obtain daily a supply of over eight million gallons of water, most of which comes from the Pebble Beds, which occupy the lower portion of each well or bore-hole. The water is of good quality, showing from nine to fifteen degrees of hardness.

On the east of the line of fault a very different state of things prevails. The rocks on this side have been dropped vertically some six or seven hundred feet. Here the surface is composed of the Keuper Red Marls, which form a broad band ten or twelve miles in width, extending from Birmingham to Shustoke. The water-supply of this tract—which has a considerable extension to north and south from Tamworth to Warwick and Redditch—is wholly derived from superficial sources, such wells as exist drawing their water from the post-glacial sands and gravels which lie here and there in hummocks on the Red Marls.

As the population on this agricultural plain of Warwickshire is comparatively small and scattered, and as there are no manufacturing towns in the district, it is, perhaps, not surprising that until quite recently no attempts have been made to reach the buried waters which probably exist in the Bunter and Keuper Sandstones that underlie the Red Marls

on the east of the line of fault. The chief obstacles to such an undertaking are the unknown—certainly considerable—thickness of the Red Marls; and the fact that no one likes to be the first to experiment in a matter in which—while there is certainly a possibility of failure—any good result obtained would be quite as much for the benefit of one's neighbours as for one's self. It would seem that such borings might well be executed by Government, or by the County Boards which it is proposed to establish, the cost being defrayed by a small tax levied on the landowners of the district.

The work of the Geological Survey has given us some information as to the probable thickness of the Red Marls. Prof. Jukes, writing of South Staffordshire,* says:—"The total thickness of this sub-formation cannot be much less than 600 feet;" and Mr. Howell, speaking of this very district,† states that "south of Birmingham the Keuper Marls attain a thickness of nearly 600 feet," and again adds "in this district, the Red Marl attains a maximum thickness of about 600 feet." However, he gives a section of a boring on the Lindley Hall Estate (four miles north of Nuneaton), about which, although a depth of 660 feet was attained, he says "it does not seem certain that they got through the Red Marl series; some of the lower beds, however, may belong to the Lower Keuper Sandstone." In a deep boring for water, at Rugby, after passing through 400 feet of Lias and seventy feet Rhaetic Beds, the New Red Marls were pierced, and found to be 670 feet in thickness; at a depth of 1,140 feet the Keuper Sandstone was reached, and a rush of water flooded the borehole; unfortunately this water was so impregnated with salt and with gypsum as to be unfit for domestic purposes.

About eight or ten years ago the Birmingham Corporation put down a bore-hole in Small Heath Park (a southern suburb of Birmingham) in search of water for certain baths and wash-houses which it was proposed to build there. A depth of 440 feet was attained, entirely in the Keuper Red Marls, before the boring was abandoned. I have seen numerous specimens of fibrous gypsum obtained from varying depths in this bore-hole.

Early in the present year Messrs. Bates, of the King's Heath Brewery, three miles south of Birmingham, resolved to make a deep boring for water through the Red Marls on

* *Warwickshire Coalfield*, Survey Memoir, 1859, pp. 41-44.

† *South Staffordshire Coalfield*, Survey Memoir, 1859, p. 4.

which their buildings stand, at a distance two miles to the east (down-throw side) of the line of fault already described. They entrusted the work to Messrs. Le Grand and Sutcliffe, of 100, Bunhill Row, London, who have successfully carried out similar undertakings in many parts of the country. The work has been rapidly carried forward, and the latest statement of results is as follows:—

Contractors' Notes.	Depth in Feet.	Geological Notes.	Feet.
Dug well	32	Post-glacial Sands ...	36
Red Sand	4		
Red Marl and Pebbles ...	8	Boulder Clay	20
Rough Ballast	12		
Red Marl	158	Keuper Marls	611
Red Marl and Gypsum...	131		
Marl, Shale, and Gypsum	309		
Marl and Shale	$3\frac{1}{2}$		
Red Stone and Shale ...	$9\frac{1}{2}$		
Total depth reached ...	667		667

There is no thick bed of gypsum, but this mineral occurs persistently in streaks and fibrous deposits throughout the greater part of the strata. Many of the cores of marl brought up are remarkably hard, affording a great contrast to the ordinarily soft and crumbling nature of the strata as we usually see them in a weathered condition in brick-pits, &c.

It is possible that the "red stone and shale"—a hard sandy marl—which forms the bottom bed now reached, marks the incoming of the Lower Keuper Sandstone. Similar strata were found at the bottom of the Lindley Hall boring. Certainly the depth already reached—667 feet—is the point at which our previous knowledge would lead us to expect the change to occur. For although the first 56 feet is occupied by surface deposits, leaving 611 feet for the Red Marls, yet it must be remembered that we are only two miles east of the fault, and that the upper portion of the Marls—to what extent we cannot precisely tell—must have been removed by denudation.

Just as the boring has reached this most interesting point, an unfortunate accident has temporarily delayed its progress. A tool has broken in the very bottom of the boring, and the removal of the broken piece is a difficult operation. But doubtless this obstacle will quickly be overcome. As to the quality of the water to be obtained from the Keuper Sandstones, the promoters of the boring doubtless hope that it will be similar to that at Burton, where the presence of a

moderate amount of gypsum in the water from deep wells sunk through the Red Marls is found to be of great value in brewing operations.

The action of a fault when it brings a thick bed of impervious material like clay or marl side by side with a porous sandy stratum—the sandy beds dipping towards the line of fault—is strikingly shown both at Birmingham and Stourbridge. In Birmingham there is any quantity of water to be had from the Sandstones and Pebble Beds right up to the line of fault. The Artesian well, about 200 feet deep, in Digbeth, must be within a few yards of the fault-line, and the water obtained is used in the manufacture of mineral waters, and is so highly prized that it may be frequently seen conveyed in a large barrel on wheels to various establishments in the town.

At Stourbridge exactly the same thing happens. A north and south fault brings Permian Marls on a level with the Bunter Pebble Beds and Keuper Sandstones, the latter dipping towards the Marls. The water is banked up by the Marls and yields an unlimited supply to the wells of the Stourbridge Water Company, which lie just on the right (west) side of the line of fault.

The Railway Company occupies the land on the marly side of the fault, and in years gone by they sank well after well in the marls in vain search for water, and the officials were much chagrined and surprised at its absence, seeing that any quantity of the precious fluid was being pumped up within a few yards of their land!

REPORT OF THE BRITISH ASSOCIATION MEETING, 1886.*

BY W. HILLHOUSE, M.A., F.L.S.
(Delegate to the Conference of Corresponding Societies.)

[ABSTRACT.]

Officially, this report refers only to such matters as came under my cognisance as your delegate to the Conference of Corresponding Societies held in connection with the meeting of the British Association, but I have extended it so far as to endeavour to bring together all those matters connected with the recent meeting in which this society or its members were directly concerned. It may thus serve as a convenient record

* Transactions of the Birmingham Natural History and Microscopical Society.

of the part the Birmingham Natural History and Microscopical Society has, directly or by its members, taken in the work of the Meeting.

As you will remember, the meeting commenced on Wednesday, September 1st, and closed on Wednesday, September 8th. In the preparatory work the members of this society naturally took an active part. Out of the (approximately) seventy-five who constituted the Executive of the Reception Committee, this society provided twenty, including one of the local secretaries. These were apportioned as follows:—

Local Hon. Secretary.—Rev. H. W. Crosskey, LL.D., F.G.S. (President, 1872).

Finance Sub-Committee.—Ald. Avery, J.P., H. Heaton, J.P., J. H. Lloyd, M.A.

Exhibition Sub-Committee.—R. W. Chase (President, 1885-6), Chairman of the Natural History Sub-Committee; Ald. W. Cook, Prof. Hillhouse, M.A., F.L.S. (Vice-President, 1885-6); Wilson Lloyd, M.P.; W. P. Marshall, M.I.C.E. (President, 1869); Edmund Tonks, B.C.L. (President, 1877); S. Walliker, A. W. Wills, J.P. (President, 1871).

Book Sub-Committee.—Prof. Lapworth, LL.D., F.G.S.; W. Mathews, M.A., F.G.S. (Vice-President, 1868); C. J. Woodward, B.Sc.

Excursions Sub-Committee.—G. H. Kenrick.

Hospitality and Lodgings Sub-Committee.—G. S. Albright, M.A.

Conversazione Sub-Committee.—Prof. Haycraft, M.B., B.Sc., F.R.S.E.; Lawson Tait, LL.D., F.R.C.S. (President, 1876).

Of the various sections into which the association is divided, the following members of the society found places on the sectional committees:—

Section A.—*Mathematical and Physical Science.*—C. J. Woodward.

Section B.—*Chemical Science.*—C. J. Woodward, Sectional Secretary.

Section C.—*Geology.*—Rev. H. W. Crosskey, Prof. C. Lapworth, and W. Mathews, all Vice-Presidents of the section; Rev. P. B. Brodie, M.A.; Alfred Browett, Rev. G. Deane, D.Sc.; G. A. Panton, F.R.S.E.; Horace Pearce, C. J. Watson, C. J. Woodward.

Section D.—*Biology.*—Prof. T. W. Bridge, M.A., and Prof. Hillhouse, sectional secretaries; R. W. Chase, M. C. Cooke, M.A., LL.D.; W. B. Grove, B.A.; Prof. J. B. Haycraft, W. R. Hughes, F.L.S. (President, 1864-6, 1873); Prof. A. Milnes Marshall, M.A., F.R.S.; W. Mathews, Lawson Tait, A. W. Wills.

SECTION F.—*Economic Science and Statistics.*—Rev. H. W. Crosskey.

SECTION G.—*Mechanical Science.*—W. P. Marshall, Vice-President of the section; Ald. T. Avery.

SECTION H.—*Anthropology.*—Lawson Tait.

The following Papers were communicated by members of the society:—

SECTION C.—*Geology.*—Prof. C. Lapworth: (1) Sketch of the Geology of the Birmingham district; (2) The Cambrian Rocks of the Midlands; (3) The Ordovician System in Shropshire.

T. H. Waller, B.Sc. (President, 1883-4): On the Petrography of the Volcanic and Associated Rocks of Nuneaton.

W. Mathews: On the Halesowen Coal Boring.

Rev. H. W. Crosskey: (1) Report on the Erratic Blocks of England and Wales; (2) On the Glacial Formations of the Birmingham district.

C. J. Woodward: On the Mineral District of Western Shropshire.

Rev. P. B. Brodie: (1) On the Discovery of Fossil Fish in the New Red Sandstone (Upper Keuper) in Warwickshire; (2) On the Range, Extent, and Fossils of the Rhætic Formation in Warwickshire.

SECTION D.—*Biology.*—Prof. Haycraft: (1) On the Sense of Smell; (2) Some New Points in the Physiology of the Tortoise.

W. B. Grove (Vice-President, 1886): Two Fungus-Diseases of Plants.

J. Morley (Vice-President, 1874-5): Note on the Cultivation of Fern Prothallia for Laboratory purposes.

Prof. Hillhouse: (1) Preliminary Note on the Fall of Leaves; (2) On an Apparatus for determining the rate of Transpiration in Plants; (3) On *Beggiatoa alba*, a bacteriad of marshes.

SECTION F.—*Economic Science and Statistics.*—Rev. H. W. Crosskey: The Character and Organisation of the Institutions for Technical Education required in a large Manufacturing Town.

SECTION G.—*Mechanical Science.*—W. P. Marshall: English and American Railways.

As one would naturally expect, the members of the society have mainly worked in connection with the sections of Geology and Biology. The meeting of the Association this year was *par excellence* a geologists' meeting. With this feature of the meeting the communications from members of this society sympathise.

Of the *Afternoon Walks*, C. J. Woodward conducted one to Moseley, Sept. 2nd, and to Pouk Hill Quarry, Sept. 3rd ; J. E. Bagnall, A.L.S. (Vice-President, 1884-5), to Sutton Park, Sept. 6th ; Prof. Lapworth, to the Lower Lickey Hills, Sept. 6th.

The *Excursions* : Ald. J. B. Stone and J. E. Bagnall, one to Sutton Coldfield ; E. de Hamel, to Tamworth ; W. R. Hughes, to Stratford-on-Avon ; E. W. Badger (President, 1881), to Lichfield, Lapworth, Hartshill ; all these on Saturday, Sept. 4th. W. R. Hughes, to Redditch and Bromsgrove ; Prof. Lapworth, to Church Stretton, on Thursday, Sept. 9th.

The "Handbook of Birmingham," issued in connection with the meeting, was largely contributed to by our members.

Part II., Chap. VIII., C. J. Woodward, the article on "Manufacturing Industries of Modern Birmingham."

Part III., "Geology and Physiography," was edited by Prof. Lapworth, who also wrote the introduction, and that part referring to the Palæozoic Rocks ; Rev. P. B. Brodie, the Liassic and Rhætic Rocks ; Rev. H. W. Crosskey, the Glacial and Post-Tertiary Deposits ; Petrography, by S. Allport, F.G.S. (President, 1868) ; C. J. Woodward, the Minerals of the Birmingham District.

Part IV., "Zoology," was edited and introduced by W. R. Hughes ; E. de Hamel wrote Chap. I., on the Mammals and Reptiles ; R. W. Chase, Chap. II., the Birds ; G. Sherriff Tye (Vice-President, 1877), Chap. III., Fishes and Mollusca ; and T. Bolton, Chap. V., Microscopic Fauna.

Part V., "Botany," edited and introduced by W. Mathews ; J. E. Bagnall contributed Chap. I., the Flowering Plants, Ferns, &c. ; and Chap. II., the Mosses, Hepatics, and Lichens ; A. W. Wills, Chap. III., the Algæ ; W. B. Grove, Chap. IV., the Fungi.

These contributions as a whole amount to nearly one-half of the "Handbook."

It may be interesting to note that a paragraph in Mr. de Hamel's account of the Mammalia of the Birmingham district, in the "Handbook of Birmingham" (p. 272), has caused the formation by the Association of a committee of seven members, of whom four are members of this society, to prepare a report on the Herds of Wild Cattle in Chartley Park and other Parks in Great Britain. Of this committee Mr. Hughes is secretary.

In the work of the committees of the Association, appointed or reappointed this year for the investigation of special points, the members of this society naturally take

only a small share. The following are the personal statistics, so far as I am able to collect them:—

Prof. T. W. Bridge, Committee to report on Herds of Wild Cattle in Chartley Park and other places in Britain.

E. de Hamel, Wild Cattle Committee.

W. R. Hughes, Sec. Wild Cattle Committee.

E. W. Badger, Committee on Preservation of Native Plants.

A. W. Wills, Native Plants Committee.

Prof. W. Hillhouse, Sec. Native Plants Committee; Committee on Provincial Museums.

Prof. Milnes Marshall, Wild Cattle Committee; Committee on the Translation of Foreign Memoirs; Committee on Naples Zoological Station; Committee on Plymouth Marine Biological Laboratory.

Dr. Crosskey, Sec. Committee on Erratic Blocks; Committee on Circulation of Underground Waters and Water Supply; Committee on the Teaching of Science in Elementary Schools.

As your delegate, I attended both meetings of the Conference of Delegates of Corresponding Societies. At these, certain subjects were submitted for discussion, which it is specially desired should be brought under the notice of Local Natural History and other Societies. These subjects, or such of them as come within the possible scope of this Society's action, are—

1.—A Committee for the purpose of investigating the circulation of the underground waters in the permeable formations of England, and the quality and quantity of the water supplied to various towns and districts from these formations.

Standing as Birmingham does on the verge of a great coal-field, the Natural History and Geological Societies of the district have peculiarly favourable opportunities of enquiring into this subject. Dr. Crosskey is a member of this Committee.

2.—A Committee, with Dr. Crosskey as Secretary, for the purpose of recording the position, height above the sea, lithological characters, size, and origin of the erratic blocks of England, Wales, and Ireland, reporting other matters of interest connected with the same, and taking measures for their preservation.

3.—A Committee, with your Delegate as Secretary, to collect information as to the disappearance of native plants from their local habitats, and to report thereon. Of this, see below.

4.—A Committee, with Mr. F. T. Mott, of Leicester, as Secretary, to report on the provincial museums of the United Kingdom. This report is with a view to "suggesting means by which such museums can be rendered still more useful to general science and to popular education," and possibly to obtaining some systematic assistance from the National Collections in London. Your Delegate is the member of this Committee for the Midland district.

5.—A Committee for the purpose of making arrangements for assisting the Marine Biological Association's Laboratory at Plymouth. Of this Committee Mr. Percy Sladen is Secretary. Assistance, both financial and moral, is needed for this institution, which it is hoped will in course of time furnish a very valuable adjunct to the ordinary appliances for scientific research.

With one of these committees the Society is connected by links of no common order—that on the preservation of native plants. This question was first brought before the members of the Birmingham Natural History and Microscopical Society in 1884 by Mr. A. W. Wills, J.P., and an article on the subject written in the "Midland Naturalist"* for August of that year. At the meeting of the Midland Union of Natural History Societies at Birmingham in June, 1885, Mr. Wills, in conjunction with Mr. E. W. Badger, and the writer of this report, brought the matter, in the first instance, before the Council, and afterwards, with their cordial co-operation, before the Conference of Delegates from Societies constituting the Union. The appeal passed by the Conference† I brought before the Committee of Section D of the British Association at its meeting at Aberdeen last year, and I was delegated to lay the matter, in the name of that Committee, before the Conference of Delegates of Corresponding Societies. This I did, and although the Conference is by its constitution prohibited from initiating resolutions, the following protest met with unanimous support, and is incorporated in the Report of the Conference submitted to the Council of the British Association at its recent meeting:—"We view with regret and indignation the more or less complete extirpation of many of our rarest or most interesting native plants. Recognising that this is a subject in which Local Societies of naturalists will take great interest, and can exercise especial influence, we urge upon the Delegates of Corresponding Societies the importance of extending to

* Vol. VII., p. 209.

† *Ibid.*, Vol. VIII., p. 227.

plants a little of that protection which is already accorded by Legislature to animals and prehistoric monuments, and of steadily discouraging and, where possible, of preventing any undue removal of such plants from their natural habitats; and we trust that they will bring these views under the notice of their respective Societies."

At the recent meeting of the Association I again brought this matter under the notice of the Committee of Section D, having in the meantime strengthened my position by communications from various parts of the country, and with such success, that upon its recommendation, Mr. Wills, Mr. Badger, and I were appointed by the General Committee of the British Association, at its meeting September 8th, a Committee—"To collect information as to the disappearance of native plants from their local habitat, and to report thereon." Mr. Wills is to be most heartily congratulated upon such a result within two years of his first drawing special attention to the subject. It now only remains for me, as your Delegate, to solicit, in the name of the Conference, the active and sympathetic interest in the work of all members of this Society, and of all readers of the "Midland Naturalist," especially in the compilation of personally-vouched-for statistics of plant extirpation or disappearance, and in the cultivation of a healthy public sentiment upon the question.

At a subsequent date I hope to lay before you an account of the Natural History Exhibition forming a part of the great collection, illustrating the various natural products and industries of the district, which was brought together in Bingley Hall as a special adjunct to the meeting of the Association.

EXCAVATIONS AT WALSALL.

I beg to submit the following short account of some vegetable and animal remains found during the making of excavations for a deep sewer through land formerly called the Racecourse, and also for a subway under the railway at the bottom of Bridgeman Street, both in Walsall.

The Racecourse, the greater part of which has very recently been converted into a Goods Wharf for the Midland Railway Company, lies chiefly in a valley, through which the

River Tame runs, the high land on the east side being due to the upheaval of the limestone hill on which the parish church stands, while the opposite or western high land is composed of ironstone and coal-measures. The valley between these high lands seems to have been formed by alluvial deposits, consisting of alternate layers of soil—fine river sand—clayey soil, &c. At a depth of about six to eight feet, very many trees, lying flat or horizontally, were come upon. They had to be chopped through. One piece was about a foot in diameter.

What was very singular, too, in cutting this sewer, a little pocket of small coal cinders was found, none larger than a small bean, at a depth of about three feet; and I was also told by the contractor that a rough-made shoe, of leather, with pointed toe, holes to lace up in front, and made apparently out of a single piece of hide, was found. It was placed near a fire to dry, but through the ignorance or stupidity of the watchman was burnt.

In the deep cutting for the subway near the old bed of the river the following was the approximate order of the deposits gone through :—Soil 1ft., clayey soil 3ft., sandy 2ft., two seams of bluish clay, one coarser than the other, 8in. or 9in.; gravelly soil about 3ft. or 4ft, another clayey deposit, and then quicksand to possibly 30ft.

Above the last clayey deposit, and about ten feet from the surface, a number of bones were found. I regret that the "navvies," not understanding the difference in value between recent and "fossilised" bones, mixed with the older remains some bones found at an earlier stage of their excavations, and therefore of very little value.

There was also found in making this subway, but whether by itself or among the lowest "find" of bones I could not learn, a human skull. Before I was informed of this last discovery, one of the men, from superstitious motives, buried it again in the quicksand, and though I offered a good reward for its recovery, it could not be found, owing most probably to an accident happening to the timber supports of the excavation, and the filling of the cutting with water, and a great influx of running sand. I was exceedingly annoyed at my non-success in recovering the relic, but it was thought to have got so deep among the buried timber that was abandoned to help in making firm ground for the foundations, that there was no hope of obtaining it, though every reasonable effort was made by the obliging overlooker.

A. D. Aulton, LL.D., Walsall.

THE MONUMENTAL BRASSES OF WARWICKSHIRE.

BY E. W. BADGER, M.A.

(Concluded from page 304.)

MORTON-MORRELL.—I am indebted to J. A. Cossins, Esq., for a rubbing of this brass plate, which reached me too late for notice in its proper alphabetical order. The plate is inlaid in a stone with incised inscription to the memory of *Anna Bagshaw*. It is 15in. square, and bears the crest, a bugle-horn stringed, and some good mantling surrounding a shield on which is a similar horn between three roses. Upon a shield of pretence are two squirrels addorsed cracking nuts.

SHUCKBURGH, UPPER.—By the kind permission of Lady Shuckburgh I have been able to obtain rubbings of the brasses in Shuckburgh Church, which is situated in her ladyship's grounds. The rubbings were, however, obtained too late for notice in alphabetical order. Dugdale gives illustrations of three memorials, comprising altogether sixteen brass plates. Since Dugdale's time the sixteen plates (which are still extant) have been unfortunately removed from their original matrices, mixed up, and relaid in great confusion. Wrong inscriptions and arms have been associated with the effigies; the inscriptions have been placed in wrong positions upon the tombstones, and four memorials have been constructed out of the original three. I will describe the brasses as they now exist, and point out the mistakes which have been made.

I.—*Margt. dau. of Thos. Shukburrgh and w. of John Cotes. Circ.* 1500. *Haines.*

This brass consists of a shield, 6½in. long, bearing the Shuckburgh arms, sa. a chevron between three mullets, pierced, arg.

Below this and *above* the effigy is a plate, 20in. by 3½in., with this inscription:—

Hic iacet Margarete Cotes ux' John̄ Cotes filii et hered' | Thome Cotes de honingham armig'i quōdā filie Thōs Shukburrgh | senyor' de Shukburrgh armig'i cui' aīe ppicietur deus. amen.

In English: Here lieth Margaret Cotes wife of John Cotes (son and heir of Thomas Cotes of Honingham, Esq.) late daughter of Thomas Shuckburgh Esq, Lord of Shuckburgh: whose soul God pardon. Amen.

Below this is an effigy, about 20in. long, representing a lady in a flowing dress. Only the plate bearing part of the dress remains; the rest of the figure has been incised in the stone recently, and was doubtless copied from Dugdale's engraving of the original figure.

The shield does not properly belong to this memorial, and the inscription should be in its usual place at the feet of the effigy. See Dugdale's illustration.

II.—*Tomas Shukburghe Esq & w. Elizabeth.* 1549 (or 1560?). *Haines.*

At the head of the tombstone is a shield, 11in. long, with the arms of SHUCKBURGH quartering NAPTON arg. on a fesse, az., three escallops of the first.

Below this are the figures of a knight and lady, about 22in. long. They are evidently by a provincial artist, and should be compared with the brasses at ASTON, COMPTON VERNEY II., and SOLIHULL I. The knight's hair is long and curly, his armour is of the ridged type, with pass-guards, roundels at the elbow joints, three tuilles, and cuspidate genouillières. He wears sabbatons, a hawberk of mail, and gauntlets which leave the fingers exposed. Upon his breastplate (or possibly hung to a band surrounding his neck) is a small crown. The same feature will be noticed in the brass of R. Verney, already referred to; indeed, the absolute similarity of the brasses is most striking. The lady wears the kennel-shaped head-dress, an outer dress with puffed and banded sleeves, and a flowing skirt which is caught up under the left arm and reveals an under-dress

There is no inscription, but the following, upon a plate, 2ft. by 4in., which has been assigned to other effigies, doubtless belongs to this brass. See Dugdale.

Hic Jacet Tomas Shukburghe armiger & Elizabethe vxor ei' quonda | dns & patronus de supiori Shukburghe qui obiit Anno dni | Millesimo quīgētesimo . . . . . . ix (lx?) prio die mensis | Octobris Quoru animab' propitietur deus. amen.

Translation: Here lie Thomas Shuckburgh Esq. and Elizabeth his wife, late lord and patron of Upper Shuckburgh, who deceased A.D. 15 . 9 (or 1560) on the first day of October. Whose souls God pardon. Amen.

Part of the date appears to have been obliterated; probably the word was "quadragesimo," as Thomas Shuckburgh was, according to Dugdale, "in Commission for Conservation of the peace from 18 H. 7. to the end of that King's Raign, and for many years in H. 8. Time."

III.—*Anthony Shukburgh Esq. & w. Anne,* 1594. *Haines.*

As now arranged, this memorial consists of a shield like the one already described in No. I., the inscription just quoted, and two effigies, about 2ft. long. Nothing of the man remains but the head, with close-cropped hair and beard, moustache, and ruff. The rest of the figure has been engraved upon the stone recently. The lady's effigy has lost part of the head-dress, which is that known as the "Paris hood." She wears a ruff, an under-dress with embroidered skirt, and gathered in pleats at the throat, and gown with wide falling collar, open in front, except just at the waist, where it is confined by a loose sash. The figure should be compared with that at Exhall.

The shield of arms over Margt. Cotes belongs to these figures, but the inscription is wrongly assigned to them, for they represent Anthony Shuckburgh and his wife, 1594. The late style of costume proves this, and any doubts will be set at rest by a comparison with Dugdale's illustration. Upon the same stone should also be a group of three boys in civilian gowns and ruffs, another of five girls attired as the lady described above; two shields emblazoned arg. two bars gules for Foxley, and a plate, 11in. by 9in., engraved with the Shuckburgh crest altered and a shield of six quarterings, Shuckburgh, Dysert, Lunell, and three others. The groups of children, the last-mentioned shields, and the following inscription of Anthony Shuckburgh form the fourth brass as they are now placed:—

Here ly buried the Bodies of Anthony Shukburgh Esquire | and Anne his wiffe: the sayde Anthony departed this lyfe the | first of Aprill in the yeare of our lorde God 1594.

Mors Mortem Vincit; per mortem post mortem Viuemus.

In English: Death conquers death: through death we shall live after death.

WIXFORD. I.—*Thos. de Cruwe, Esq., and w. Juliana,* 1411. *Haines.*

This is the finest brass in the county. The two effigies, each 5ft. long, are placed beneath a double canopy 8ft. high and 3ft. 2in. wide, with crockets upon the pinnacles and

finials. At the upper left corner of the tomb is a shield bearing the BEAUCHAMP arms; on the right of this another shield bore the arms of CRUWE (a lion rampant) impaling the arms of Juliana de Cruwe. A third shield bore the lion rampant, now obliterated, and a fourth (restored) has the cross of S. George. Below the shields and between the pinnacles and finials are four representations of a left foot, and the same badge occurs in the pediment of the canopy, in panels at its base, within circles at its lower corners, and between the words of the marginal inscription. No explanation of this seems forthcoming, except that it is "a family badge." At the base of the canopy in the centre is another shield of arms. The knight is in a complete suit of plate armour; bascinet with opening for the face, gorget, breastplate with skirt of seven taces, and baguette, epaulières, palettes at the armpits emblazoned with the cross of S. George, brassarts with straps and buckles, coutes, roundels, vambraces, and gauntlets. The legs are covered with cuisses, genouillières, jambs, and sollerets. The sword-belt has been omitted. At the knight's feet is a lion.

The lady, who is at the knight's right hand, wears the crespine head-dress, kerchief, mantle drawn together with cords, and a kirtle fitting closely, with long sleeves reaching to the knuckles, and buttoned underneath with sixteen buttons. At her feet is a lap-dog with a collar of bells.

Round the margin of the tomb is this inscription, with the family badge after each word:—

Hic jacent Thomas de Cruwe Armiger | qui istam capellam fecit fieri qui obiit . . . die mensis . . . Anno domini millimo ccccº | . . . et Juliana uxor eius que obiit | vicesimo die mensis decembr Anno dñi millesimo ccccº undecimo quom animabȝ ppicietur deus. Amē. Amen.

Translation:

Here lie Thomas de Cruwe Esq. who caused this chapel to be built who died . . . day of the month . . . A.D. 14 . . . . and Juliana his wife who died Dec. 20. 1411. Whose souls God pardon. amen.

It is evident that the lady died first.

Thomas de Cruwe was attorney to Margaret Beauchamp in 1406 (see the brass at S. Mary's, Warwick). He was knight of the shire in the "Layman's Parliament" at Coventry. He was also steward to Richard Beauchamp, Earl of Warwick, which connexion is commemorated by the first shield upon his tomb. He died in 1418.

II.—*Inscription. Jane Alline,* 1587.

Upon a plate, 17½in. by 7½in., on the floor of the nave is the following :—

Here lieth the bodye of Jane Alline sometime the wi | ffe of John Alline which did bequeathe her selfe to | be buried in Wixforde Churche and this said Jane | Alline had Jsshew by her trewe and lawefull husband | tenn cheldren that is to saye Anne Margret Marge | xy Anne Elizabeth John Marye Alse John Jssabell this | Jane Alline departed this transitory life the xviiith | daye of Aprell Anno domini: 1587. Jesus.

III.—*Rise Griffyn,* 1597. *Haines.*

A plate 15½in. by 10in., upon which is engraved a shield with the arms of GRIFFYN sa., a griffin segreant arg. with eleven quarterings. Below this is engraved an arch upon columns, beneath which at a prayer desk kneels a boy in a civilian's gown.

Underneath is this inscription :—

HERE LYETH THE BODIE OF RISE GRIF-
FYN FOVRTH SON OF RISE GRIFFYN OF
BROME IN Y^E COVNTIE OF WARWIKE ESQV-
IER, HE DECEASED . . . DAYE OF JANVARY
AND BEING IN HIS INFANCYE BEING BVT
THREE QVARTERS OLDE ANNO DNI 1597.

The whole is in an oak frame in the vestry.

WOOTTON-WAWEN. I.—*John Harewell, Esq.,* 1505, *and w. Dame Anna. Haines.*

The figures are about 3ft. long, and lie upon an altar-tomb in the chancel.

Above the effigies are two shields, one of which is ar. upon a fess wavy sa. three hares' heads couped or, for Harewell. Below the effigies are groups of five sons and five daughters, and below these two more shields with various quarterings.

The man wears his hair long. Over his mail shirt is plate-armour of a heavy massive kind, the upper edges of the pauldrons being lengthened and curved upwards (especially upon the left shoulder) to form *pass-guards* and protect the neck from a sword-cut. Haines says "the breast and back-plates have a large skirt apparently composed of small oblong plates, with one tuilette depending from it at the front and

two at the sides. This peculiarity . . . is perhaps intended for the skirt of lamboys (Gall. *lambeau*), which was a puckered skirt of cloth or velvet, worn over the thighs, and sometimes imitated by plate-armour." The feet of the knight are encased in broad sabbatons, and his sword is worn at the left side. The lady wears the kennel head-dress, a close-fitting under-dress, and an outer gown with loose sleeves. Round her waist is a belt fastened with three metal rosettes, from which depends a chain supporting an elaborate pomander. Compare COLESHILL II.

Round two edges of the tomb runs this inscription:—

Hic iacet Johēs harewell Armig' & dnā Anna quondm uxor eius Ac nup | uxor Edwardi Grey militis qui quidm Johannes obiit x die aprilis Anno dnī m v: v° Et que quidm Anna obiit die A° dnī m° v quor aīabs ppicietur deus.

Translation: Here lieth John Harewell Esq. and Dame Anna late his wife and formerly wife of Edward Grey, knight; which John died the 10th of April 1505, and which Anna died the . . . . day . . . . A.D. 15 . . . whose souls God pardon.

These spaces were left to be filled in when the wife died.

II.—*Inscription. Lady Agnes Smyth*, 1562.

Upon a plate, $20\frac{1}{2}$in. by 6in., mural, in the S. Chapel used as a vestry.

HERE LYETH THE BODIE OF LADYE AGNES SMYTH
LATE WIFE OF S[R] JOHN SMYTH KNIGHT ONE OF THE
BARONS OF THESCHEQVIER, DAVGHTER OF JOHN HAR
WELL ESQ. & ONE OF Y[E] COHEIRES OF THOMAS HARWELL
ESQ. HER BROTHER W[CH] AGNES DYED Y[E] 15[TH] OF FEBR. 1562

BRASSES IN PRIVATE POSSESSION.

BADDESLEY-CLINTON HALL.—*A lady in heraldic mantle. Circ.* 1500.

By the kindness of Mrs. Dering, of Baddesley-Clinton Hall, I am enabled to furnish an account of this brass, of which Haines makes no mention. It is preserved in the private chapel of the Hall, and probably was once in the parish church. It represents a lady kneeling upon a cushion embroidered with quatrefoils, her hands clasped in prayer. Upon the first and third fingers of the left hand are rings. She wears the kennel-shaped head-dress, a mantle drawn together with long tasselled cords, and a kirtle. Upon the

mantle are emblazoned the arms of Brome: sa., on a chev. arg. three broom sprigs vert., quartering ARUNDELL sa., six hirondelles, arg., 3. 2. 1.

The kirtle appears to be emblazoned ermine.

It is supposed by a writer (the Rev. Father Norris) in *The Oscotian*, Vol. IV., No. 15, Dec., 1885, that "it is a memorial of Elizabeth Arundell who married Nicholas Brome, or of their daughter Constance who married Sir Edw. Ferrers."

The figure has been prepared by coarse hatching to receive enamel or some resinous composition, to express the sable tincture, but no traces of colouring matter remain.

WROXALL.—*A lady.* *Circ.* 1430. *Haines.*

This effigy, 2ft. 1in. long, is now in the possession of J. B. Dugdale, Esq., of Wroxall Abbey, who kindly allowed the writer to make a rubbing. The lady wears that development of the crespine head-dress, called the horned head-dress, which arose from the side cauls of the former being so enlarged that the outer edges stood above the forehead. Over this is thrown a kerchief which falls upon the shoulders. Over her kirtle the lady wears a long gown with falling collar. It is girt under her breasts, and has very deep sleeves, close and edged with fur at the wrists. A precisely similar figure will be found in *Haines*, p. 210.

The brass is "said to have been originally in Brailes Church, but no matrix corresponding to it remains there." *Haines.*

THE PRINCIPLES OF BIOLOGY.*

BY HERBERT SPENCER.

EXPOSITION OF PART IV., CHAPTERS VI. TO XII.

"THE MORPHOLOGICAL COMPOSITION OF PLANTS."

BY W. HILLHOUSE, M.A., F.L.S.

[ABSTRACT.]

The subject of these chapters is the progressive differentiation of plants, either as wholes, or as to their several members considered separately. The ability to approach the subject at all is dependent upon the possibility of defining vegetable forms *per se*, and of strictly correlating the modifications to which their members are subject. From *a priori*

* Birmingham Natural History and Microscopical Society, Sociological Section, Dec. 17th, 1885, and Jan. 21st, 1886.

considerations this should be possible, seeing that every plant of whatever kind consists, at some stage of its existence, of a single vegetable cell; hence all the changes which it subsequently undergoes are in the nature of modifications impressed upon the organism either by external or internal causes. Could we classify and analyse internal forces in the same sense that those operating from the exterior are subject to classification and analysis the matter might become easy.

The forces bearing upon and producing morphological differentiation Mr. Spencer considers to be :—

(1).—*Growth*, by altering the relations of the organism with the factors of nutrition, and therefore affecting different parts in differing degrees.

A remarkable yet simple illustration of this is to be derived from our modern knowledge of the method of development of starch-grains. Adhering to, or half immersed in, the side of the "feeder" from which they derive their nourishment, their form at first is globular, for nutrition is practically equal in all parts. As they enlarge, the parts remote from the feeder receive less food than the proximal portions, and in proportion to their remoteness. Hence the form becomes progressively more and more eccentric, the eccentricity increasing in geometrical proportion.

(2).—*Mutual influences, e.g.*, the pressure of new units on old ones, etc. Thus, two typically globular cells, passing into permanent union, would do so by flat contact-faces. Break a filamentous alga, and the flat end-walls of the cylindrical cells at the rupture-point will bulge and become hemispherical by removal of pressure. Again, very actively growing cells will stretch less actively growing cells in union with them. Hence the production of spiral vessels with exceedingly open spirals in the immediate neighbourhood of the pith of an actively growing stem. Again, the new units may cut off light from those older, and, at least in such cells as are dependent on light, will bring about manifest changes. In like way would come about the evolution of a mechanical tissue. Compress the vital operations of a vegetable cell into smaller compass, and you produce equivalent increase in mechanical development. Hence the need to support a weight in itself induces ability to support it.

To these two forces ought probably to be added another, at present, however, indefinable, but to which we can give the name of *inherited tendency*. Neither growth nor mutual influences can account for the development of, for example, hairs upon an epidermis.

(3).—External forces act unequally on different parts and sides of an aggregate.

This is most markedly manifest in respect to light, but holds good equally for all exterior forces, bearing in mind that, in addition to the sides, commonly so called, the plant likewise has outside and inside.

In order to obtain the classification of form he hypothecates, Mr. Spencer proceeds to give certain definitions, such as *asymmetrical* for utterly irregular forms, *unsymmetrical* for those approximating to regularity. Of symmetry itself, we have that of the sphere, *spherical symmetry*, as the most primitive. He asks you then to consider the gradual flattening of a sphere to a plane, this latter having *radial symmetry*. Another kind of symmetry appears needed here, that of the cylinder, showing equi-radial symmetry in a series of consecutive planes. Further, there is *bilateral symmetry*, which may be *triple*, *i.e.*, divisible into equal and similar parts in three planes at right angles, *e.g.*, a brick or shuttle, *double*, divisible in two planes at right angles, *e.g.*, a canoe, and *single*, divisible in but one plane, as in a boat. These terms might be conveniently replaced by triaxial, biaxial, and uniaxial symmetry respectively.

The process of evolution would theoretically progress from perfect spherical to single bilateral symmetry. This is apparently true in fact.

The simplest plants, amongst aggregates of the first order, that is, unicellular organisms, are spherical. The author selects *Protococcus* as his illustration; the coccus forms of bacteria would perhaps provide the best illustration, as, being independent of light, and of aquatic habit, they can be symmetrical from the point of view of external forces also. Spherical symmetry is indeed due to the equality of internal and incident forces. The most modern theory of cell-nutrition is that the nucleus is, in the ultimate, the feeder. For spherical symmetry the nucleus should be central; this it apparently is. Directly the nucleus becomes a-central, spherical symmetry would be lost, unless counterbalanced in some way. Triaxial symmetry exists in diatoms and desmids, and is associated with motility, and triaxial symmetry in the arrangement of forces. A cylinder may possibly be looked upon as a case of multiaxial symmetry.

In *Caulerpa* we have a fixed unicellular organism. In all fixed organisms the primary difference is between the free and fixed ends, *i.e.*, the disappearance of the spherical and tendency to radial or to multiaxial symmetry. Another illustration can be obtained from the mycelium of a

unicellular fungus; this is independent of light, and therefore simpler in its external relations. Spencer looks upon this as asymmetrical; rather is it not radially symmetrical? The segments, truly, are not exactly like, neither is exactitude demonstrable in spherical symmetry. Transitions to aggregates of the second order are found in filamentous algæ, *e.g.*, *Spirogyra*. These show radial symmetry of the cylindrical type. Primævally the cells, doubtless, were spheres with flattened contact-walls; the action of forces has brought their form through the barrel to the cylinder. *Nostoc* and *Batrachospermum* supply connecting links.

(To be continued.)

METEOROLOGICAL NOTES.—October, 1886.

There were some remarkable variations in the barometric pressure of the month, which showed the unusual range of 1·719 inches. A fall of rather above an inch in the mercurial column took place from the 14th to the 15th; the 6 p.m. readings being, on the 14th 29·666 inches, on the 15th 28·631 inches. From this latter date the mercury rose steadily, reaching 30·356 inches on the 25th. The month was generally mild, the mean temperature being nearly three degrees above the average. On the 5th, 77·1° was registered at Loughborough, and 71·0° at Strelley; 74·0° at Coston Rectory, on the 1st; and 71·1° at Hodsock, on the 4th. In the rays of the sun, 118·5° at Loughborough, on the 1st; 117·0° at Hodsock, on the 3rd; and 107·5° at Strelley, on the 4th. The high temperature of the 4th and 5th was unprecedented at Loughborough in this month during the previous eight years. The minimum temperatures were above the average; the lowest recorded being 31·1° at Hodsock, on the 23rd; 34·2° at Coston Rectory, on the 22nd; 35·5° at Strelley, on the 22nd; and 35·7° at Loughborough, on the 23rd. On the grass, 27·0° at Hodsock, on the 14th and 23rd; 32·0° at Strelley, on the 22nd; and 32·1° at Loughborough, on the 23rd. Rainfall was rather excessive, though above an inch less than in October, 1885. The total values in inches were:—Strelley, 4·74; Loughborough, 4·48; Coston Rectory, 3·98; Hodsock, 3·08. The number of "rainy days" varied from eighteen to twenty-two. Severe thunderstorms visited Strelley and Loughborough during the afternoon of the 20th. Sunshine was very deficient.

Wm. Berridge, F. R. Met. Soc.

12, Victoria Street, Loughborough.

Natural History Note.

The Boleti of the Birmingham District.—A few days after my article on this subject was printed, I found several typical specimens of *Boletus luteus* in Sutton Park, and near to them some very fine specimens of *B. piperatus*, both in Westwood Coppice.—W. B. Grove.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—At a meeting of the Biological Section held on Tuesday last, Mr. W. P. Marshall in the chair, Mr. J. E. Bagnall exhibited on behalf of Mr. J. B. Stone, J.P., several beautifully prepared specimens of the Cactus tribe of plants from Mexico, representing the genera *Mamillaria*, *Opuntia*, *Echinocactus*, and *Cereus*, with notes on their morphology, habitats, and geographical distribution. A copy of Gerarde's "Herball," 1636, was also exhibited, from which Prof. Hillhouse, M.A., read the quaint description given by this author of *Cereus*, which had just then been brought into cultivation; also, in illustration of a previous exhibition, the graphic description given by Gerarde of the origin and development of the Barnacle Goose. An interesting discussion followed.—MICROSCOPICAL SECTION, November 16th. Mr. R. W. Chase in the chair. Mr. Pumphrey exhibited a series of beautiful photographs of flowers, some taken by himself and others by Mr. Wills.—GEOLOGICAL SECTION, November 23rd. Mr. T. H. Waller in the chair. Mr. W. P. Marshall read a paper on the "Motion of Glaciers" (modern theory of), which will be printed in a future number. Mr. R. W. Chase exhibited *Mustela martes.* Mr. Grove exhibited a number of fungi. Mr. Bolton exhibited a flagellate monad, probably new.—An enthusiastic meeting was held on Tuesday, November 30th, at the Mason College, when Mr. R. W. Chase occupied the chair, the subject of the evening being "Photo-Microscopy." Mr. J. Edmonds in his lucid style gave a popular description of the apparatus he used, which was of simple construction, and as he took the views at night, no camera was needed. He explained that the negatives were taken on the Ilford ordinary plates, while the positives were on Mr. Alfred Pumphrey's new lantern plates, which gave very brilliant effects. The views were thrown on to the screen by the use of the new large oxyhydrogen lantern belonging to the society, which was very skilfully manipulated by Mr. Charles Pumphrey. Mr. Edmonds then explained the views as they appeared on the screen, his descriptions sometimes causing a laugh amongst the audience, as some well-known tiny object appeared of an enormous size on the screen, and showing the intricate and beautiful structure, the uses of which he explained at the same time. Of the insects that were shown were the following, amongst many more:—The scorpion fly, the mosquito, showing the lance; several new crustaceans and a new caddis worm in its bottle-like home, the jaws of a spider, the head of a wasp, with its trowel-like tongue and other appendages; the compound eye of a beetle, which could see round a corner, so that the old adage, "blind as a beetle," is a very questionable quotation; the tongue and gizzard teeth of the cricket, the spiracles and trachæa of the water beetle, showing the breathing tubes ramifying into the smaller vessels, and then a greatly magnified view showing the "water-markings" caused by the crossing of the lines. He also showed photos of sections of plants, as the stem of the bracken fern *(Pteris aquilina)*, illustrating its structure and the scalariform vessels *in situ;* also a variety of diatoms and other objects. Mr. T. H. Waller, B.A., then exhibited a series of photos of rock sections, which he described as Mr. Pumphrey threw them on to the screen, amongst which were spherulites in the obsidian of the Yellowstone Rock, U.S.A.; section showing the lava flow in rock from the Wrekin; and another showing the junction of

granite and schist in the Cornwall Rocks; also sections of rocks from Nuneaton. Some views were then exhibited of instantaneous pictures showing the breaking of a wave, the ripple on a river, etc., and some interesting Alpine views recently taken by Mr. Watson. Mr. W. H. Wilkinson exhibited a specimen of the "mazewort" (*Dædalia quercina*), from Clent, a fungus which (unlike most of its family) does not soon perish, as this specimen was as perfect as when gathered four years ago; also a fine cluster of *Xylaria hypoxylon* in fruit, from Shrewsbury. There was a large attendance of members, who throughout the evening evinced the deepest interest in the very varied and instructive exhibitions, and a hearty vote of thanks was carried by acclamation to Mr. Edmonds and to Mr. Pumphrey.

BIRMINGHAM MICROSCOPISTS' AND NATURALISTS' UNION.—October 18th. Mr. J. W. Neville exhibited a specimen of lace sponge, *Euplectella aspergillum;* Mr. J. Madison, *Planorbis lineatus*, var. *albina*, from Deal, and *Ancylus fluviatilis*, var. *albida*, from Earlswood; Mr. C. F. Beale, two fossil fish, *Platysomus parvulus* and *Elonichthys Egertoni;* also a mandible of *Megalichthys Hibbertii* from Deep Mine ironstone, Longton; Mr. Corbet, a fossil fern, *Pecopteris longitita;* Mr. J. Harrison, black and white crystals of quartz from Japan. Under the microscopes Mr. J. W. Neville showed spicules of lace sponge; Mr. H. Hawkes, section of *Peziza vesiculosa*, showing sporidia in asci; Mr. H. Insley, dendritic spot on paper; Mr. Wagstaff, *Campanularia neglecta*.—October 25th. Mr. Deakin exhibited a nest of bullfinch; Mr. Hawkes, specimens of *Agaricus dryophilus;* Mr. Rodgers, specimens of *Helix cantiana* from Fenny Compton; Mr. H. Insley, spine of *Pleuracanthus livissimus* from the coal-measures, Bentley. Under the microscope Mr. Hawkes showed a section of bud of horse-chestnut, showing the future flower scape. A paper was then read by Mr. J. Harrison, "Notes on Fishes." The writer took as a type the common codfish, describing in passing the various kinds of fish scales, as placoid, cycloid, and ctenoid. The lateral line was described as a sensitive surface, and its peculiar scales shown. Fins were described as steering organs, and the teeth, kidney, air sac, and auditory organs were dealt with at some length. A description of the heart and its action, the ovary, and methods of reproduction brought the paper to a close. The subject was well illustrated by diagrams and specimens.—November 1st. ANNUAL MEETING. Mr. C. Beale, C.E., the retiring president, delivered an address congratulating the members on the result of their work during the past year, and suggesting various ways of widening the usefulness of the society by admitting associates and other means. The impetus given to science by the late meeting of the British Association was referred to, and the interest excited by the Natural History section of the exhibition gave promise of abundant fruit in the future. The growing love for natural objects was likely to make this section a popular feature in most future exhibitions. The fossiliferous pebbles from the Drift were specially mentioned as showing what careful and patient work could accomplish. The address concluded by pointing out the good work being done by the "Practical Naturalists' Society," a society that all scientific workers would do well to recognise. Mr. John Edmonds was unanimously elected president for the ensuing year, and Messrs. C. F. Beale and F. Holden vice-presidents.—November 8th. Mr. C. P. Neville exhibited a series of quartz crystals from Welsh lead mines; Mr. H. Hawkes, the following fungi:—*Russula emetica*, *Lactarius*

rufus, *Lycoperdon saccatum*, and *Polyporus sulphureus* from Handsworth Wood; Mr. Beale, a cluster of various corals from the Wenlock beds, Dudley; Mr. J. Harrison, a specimen of *Trigonia gibbosa* from the great Oolite; Mr. C. F. Beale, *Helix caffra*, *H. rivolii*, and other tropical shells. Under the microscope Mr. H. Hawkes showed a vertical section of flower of mignonette. A paper was then read by Mr. H. Insley on "The Probable Condition of the District at the Close of the Coal Period." The writer described the various rocks accompanying the coal seams, and spoke of the conditions they indicated, tracing the rise and decay of forest conditions from the bottom coal through the "thin," "herring," and "brooch," to an attenuated 4½in. seam which indicated a final vegetable struggle, resulting from a slight recurrence of past conditions. The overlying beds of fireclays, shales, sandstones, and marls were described, their fossils showing them to be strictly coal-measures, dwindling and dying out in a shaly bed 209yds. below the surface at Hamstead. The rocks indicate that the coal period ended in a great lake aspect, around or near which coal plants struggled and ultimately died out. A number of sketches and fossils illustrated the paper.—November 15th. Mr. A. T. Evans showed fossiliferous pebbles from the Drift containing *Sigillaria*, *Stigmaria* rootlets, &c.; Mr. C. F. Beale, ancient cornelian arrow points from Arabia; also a shell celt from Barbadoes; Mr. J. W. Neville, seedling plants of gorse, showing the transition from trifid leaves to thorns; also photo-micrographs of insects; Mr. Deakin, land shells from Bridport, including specimens of *Helix virgata*, var. *minor*, and a conical variety of the same.

LEICESTER LITERARY AND PHILOSOPHICAL SOCIETY. —SECTION D, ZOOLOGY AND BOTANY. Chairman, F. T. Mott, F.R.G.S. Monthly Meeting. Wednesday, November 17th. Attendance, fourteen (two ladies).—The chairman stated that Mr. Vize had sent him a specimen of *Tremella albida*, a fungus not previously recorded in the county. He also said that he had found at Beaumont Leys, a fortnight ago, a large group of the very handsome fungus *Agaricus rachodes*, which was formerly considered poisonous, but was now known to be edible. He had had several of them cooked and found them particularly excellent. Mr. Garnar exhibited specimens of the small crustacean *Asellus aquaticus*, common at the bottom of ponds, and in which the circulation of the internal fluid was very distinctly seen under the microscope. He read an account of this animal extracted from several works, but stated that the principal work upon the subject was in French, and was not procurable in Leicester. Mr. E. F. Cooper, F.L.S., exhibited dried specimens of several rare British plants, and stated that a white rat and a white-headed blackbird had been seen in the gardens of Mr. A. Paget, J.P. Dr. Finch exhibited a dried specimen of a remarkable variety of the common foxglove. Dr. Tomkins read a short paper on "The Cultivated Bacillus of Anthrax." He described the disease of anthrax, or woolsorters' disease, or malignant pustule, or splenic fever, which appeared at Arnesby in this county some months ago in some cattle, probably caused by their drinking from a stream polluted by the washing of foreign skins. Several men caught it from the cattle and one died. Dr. Tomkins had obtained matter from the pustule, and found it swarming with the characteristic bacillus, mixed with a common micrococcus. He had cultivated the two together in nutritive gelatine, and found that in these conditions the micrococcus gradually overpowered and finally extirpated the bacillus.